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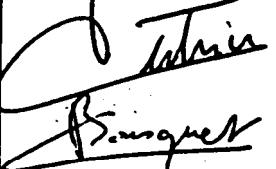
Title

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**ADVANCED DATA COLLECTION SYSTEM
INSTRUMENT INTERFACE CONTROL DOCUMENT**

-A-DCS ICD

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- AD4.** Electromagnetic Interference Characteristics, Measurement of, **MIL-STD-462C**.
- AD5 ADCS RPU Interface Control Drawing, Ref. **8212-200E380**
- AD6** ADCS TXU Interface Control Drawing, Ref. TBD
- AD7 STE-PS Platform Simulator Operation and Maintenance Manual, Ref. **ADII-372-MU-03-CN**

1.133. Reference Documentation

- RD1.** ATN-K,L,M General Instrument Interface Specification, Ref. IS-3267415
- RD2. Single Space Segment, Search & Rescue, DCS System Specification
Ref. MO-RS-ESA-IN-0087.

1.13. Acronym List

AD	Applicable Document
A-DCS	Advanced Data Collection system
AGC	Automatic Gain Control
AIT	Assembly, Integration & Test
AV	Assembly, Integration & Verification
AMSU-AI	Advanced Microwave Sounding Unit 1
AMSU-A2	Advanced Microwave Sounding Unit 2
ARGOS	Meteorological Data Collection and Location System
ASCAT	Advanced Wind Scatterometer
AVHRR/3	Advanced Very High Resolution Radiometer
BOL	Beginning of Life
C&C	Command & Control
CAM	Coarse Acquisition Mode
CCU	Central Computer Unit (SVM)
CR	Customer Furnished Instrument
CRA	Combined Receive Antenna (A-DCS , SARR, SARP-3)
DBU	Digital Bus Unit
D C	Direct Current
DRU	Data Recovery Unit
DSPG	Distributed Single Point Grounding
DTA	DCS Transmit Antenna
EGSE	Electrical Ground Support Equipment
EMC	Electromagnetic Compatibility

OCOE	Over Check-Out Equipment
OMI	Ozone Monitoring Instrument
P/F	Platform
P/L	Payload
PA	Product Assurance
PCU	Power Conversion Unit
PLM	Payload Module
PMC	Payload Module Computer
RD	Reference Document
RF	Radio Frequency
WC	Radio Frequency Compatibility
RFF	RF Filter
rms	root mean square
rpm	round revolutions per minute
RRM	Rate Reduction Mode
Rx	Receive ; Receiver
S&R	Search and Rescue
S/C	Spacecraft
S/L	satellite
S/S	Subsystem
S/W	Software
SARP-3	Search and Rescue Processor
SARR	Search and Rescue Repeater
SEM-2	Space Environmental Monitor
SLA	S&R L-band Tx Antenna
SVM	Service Module
TB/TV	Thermal Balance / Thermal Vacuum
TBC	To be confirmed
TBD	To be defined
TC	Telecommand
TCU	Thermal Control unit
TM	Telemetry
TT&C	Tracking, Telemetry, and Telecommand (LEOP) , Emergency, and Stand-by
Tx	Transmit, Transmitter
YSM	Yaw Steering Mode

The receiver **characteristics** are the following :

Centre Frequency	401.65
Antenna Polarization	RHCP

1.2.3.2. control unit

The control unit sequentially scans the search unit channels. It makes a binary estimate of both the signal level and frequency. These two digital words are stored in the Control Unit and are used for the assignment of a DRU to a particular receiver output signal.

1.2.3.3. Data Recovery Unit

The DRUs perform the following signal functions : acquisition of the carrier, signal demodulation, bit synchronization, frame synchronization, Doppler counting decommutation, and formatting of the data.

1.2.3.4. Telemetry Encoder and Memory

The telemetry formatter interrogates the buffer in the DRUs. When the buffer is full, the encoder sends a command to shift the bits into memory. When the data transfer signal from the satellite is received by the encoder, it transfers the data out of the memory to the satellite.

1.2.3.5. Transmitter

The A-DCS instrument will be able to send messages to the users mobile terminals through its UHF transmitter (465.9875 MHz bi-phase PM 200 or 400 bps).

The user requests will be received at the Toulouse facilities of CLS, the CNES subsidiary in charge of the operations of the ARGOS system. These requests will indicate the identification of the destination terminal, the message to be transmitted at 200 bps (or 400 bps) and the time constraints (if any).

Taking into account the above and the status of the ARGOS system, the Downlink Message Management Centre (DMMC) will prepare the uploading of the request to the instrument through one of the Master Beacon of the ARGOS system.

The best situated Master Beacon is selected by the DMMC and the message to be uplinked is sent to this Master Beacon through terrestrial public network. This uplink message contains the information necessary to prepare the downlink message to be sent to the user terminal.

The uplink message is a "normal" ARGOS message the content of which is analysed upon reception by the instrument which in turn prepares the downlink message to be included in the downlink HDLC bit stream transmitted by the UHF transmitter.

In summary the function described is independent of the satellite operations and has no impact on them, e.g. the downlink is permanent and when there is no downlink message, the downlink transmits 7E7E7E...

1.3. METOP SYSTEM OVERVIEW

13.1. **Spacecraft** Architecture Concept

(For information only)

The METOP spacecraft is a **geocentric**, three-axis **stabilized satellite** placed **in** an Earth **Sun-synchronous** orbit.

The satellite consists of the **Service Module (SVM)** and the **Payload Module (PLM)**.

The SVM provides :

Interface with the launcher

On-board data acquisition

Power generation, storage, **distribution**

Housekeeping : **SVM thermal** control, pyro **and** thermal knife command generation

The PLM provides :

- **Instrument accommodation estate**
- **Instrument command and control** interface
- Measurement data acquisition and storage
- **Measurement data formatting** and downlink
- PLM thermal control
- **Instrument** housekeeping and thermal **control**
- Power **conversion** and distribution

The METOP satellite in-orbit configuration is illustrated in Figures 1.3.1/1. The **internal** PLM lay-out is illustrated in Figure 1.3.1/2.

The A-DCS interfaces with **the** following PLM units :

- the NOAA **Instrument Interface Unit (NIU)** provides all **command and control interfaces** to the A-DCS. i.e. **configuration** and mode **switching** (commands), command **verification**, **housekeeping** **telemetry acquisition**, and clock and time **management**. The **NIU** acquires the **measurement** data from the **instrument**.
- the Power Conversion Unit (**PCU**) provides the A-DCS with the regulated buses.

In addition, the **Thermal Control Unit (TCU)** provides heater power supply **for** the **thermal** control of the units.

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TBD_{NET}

WARNING : MAY BE SUBJECT TO CHANGE

Figure 1.3.1/2 : Internal Lay-Out (For Information Only)

13.4. Satellite Mission Phases and Operations

13.4.1. Mission Phases

During its lifetime, the satellite is **operated** through the following **mission** phases :

- **Launch Phase**

The proper launch phase begins at the instant of switching the power subsystem to on-board batteries before lift-off and ends at satellite/launch vehicle separation.

- **Acquisition Phase**

This phase starts at the end of the launch phase and ends once the satellite has acquired its operational attitude and orbit with its appendages deployed. An initial acquisition sequence leading to a system secured state, is followed by a **final acquisition period**.

- **Commissioning Phase**

This phase starts once the attitude and orbit have been acquired and covers the time that subsystems and instruments are checked out. It ends when the payload is operational for the **nominal** orbit.

For METOP-1, it starts when the satellite is still drifting to achieve the nominal local solar time of 09:30.

- **Routine / Operational Phase**

This phase starts at the end of the commissioning phase and covers the time when the instruments are operational and the times when orbit maintenance manoeuvres are performed.

13.4.2. Satellite **Operational** Modes

(For **information** only)

This section describes the satellite operational modes..

1.3.4.2.1. **Nominal** Operational Mode

The **nominal** operational mode for METOP SVM is the Yaw Steering Mode (**YSM**¹). During this mode, the PLM is in its Operable Mode : the instruments can be nominally operated through their different modes.

1.3.4.2.2. Orbit Control Modes

Orbit control manoeuvres for altitude maintenance or **inclination maintenance** are performed in SVM Orbit Control Mode (OCM) or **Fine** Control Mode (**FCM**).

¹ During the Yaw Steering Mode (**YSM**), the satellite Z axis (yaw) is steered according to sinusoidal function over the orbit with an amplitude of about 4 deg.

1.4. INSTRUMENT OPERATIONAL MODES

1.4.1. Operational Constraints

To assure proper in-orbit operations of the A-DCS, certain practices are to be observed during the mission phases (see § L3.4.1.). These are :

- a) The initial configuration on the ground and during launch for A-DCS is the Off Mode.
- b) The A-DCS can be operated within the constraints herein defined, at any time during the drift orbit.
- c) When initiating the A-DCS Mission Mode, the RPU shall be first switched on, a 120-minute period shall be observed to get temperature stability for the USO before any of the DRUs is switched on.
- d) It is not an issue for A-DCS to have RF signals at its input port when it is off.
- e) The nominal operating mode for the A-DCS is the A-DCS Mission Mode. There is no specific requirement from the PLM during this mode.
- f) In case of PLM failure, the clock / signal and power (10 & 28 V) may not be available at the instrument interfaces for a maximum duration of 36 hours.
- g) The measurement data acquisition of Digital A Data from A-DCS may be corrupted in case of spacecraft failure (i.e. Data Enable and Clock interrupted and Sync. pulses present). In this case, the instrument shall be reset by ground command i.e. by powering down to Off Mode and following powering up the instrument to Mission Mode.

1.4.2. Instrument Mode Overview

1.4.2.1. A-DCS Off Mode

During the A-DCS Off Mode, the A-DCS is unpowered. No service (telemetry, monitoring...) will be performed by the METOP satellite, except thermal control.

This Off Mode for A-DCS is used :

- during the METOP launch and acquisition phases.
- during the METOP contingency cases (see § 1.3.4.2.4.).
- during the METOP safe mode (see § 1.3.4.25.).

The Switched TLM bus is available at the instrument interfaces only during the PLM Stand-By and Operable modes. The temperatures will be monitored only during these PLM modes.

All interface power buses and signals shall be available at the interfaces of the A-DCS to exit this mode.

15. INSTRUMENT LAUNCH AND IN-ORBIT OPERATIONS

15.1. General

Instrument operational constraints are presented in § 1.4.1.

The minimum time between two consecutive commands is **specified in § 3.2.2., except as noted below.**

A-DCS **telecommands** are described in § 3.2.2..

The acknowledgement of the commands' by the 'instrument is not done on-board but on the ground with Digital B and Analog Housekeeping telemetry points, as **described in § 32.3.**

Instrument operations during tests are described in § 5.

15.2. instrument Sequences to A-DCS Off Mode

1.5.2.1. Nominal Sequence to Off Mode

The A-DCS instrument sequence to Off Mode shall be as following :

- 1) TBD_{ADCs}

1.5.2.2. Emergency Sequence to A-DCS Off Mode

In case of emergency (including depointing), the same command sequence as described in § 1.5.2.1. shall be issued by the NIU to the instrument, to switch down the A-DCS to Off Mode.

This emergency switch-off sequence shall be completed within 50 s.

No power and no interface signal will be available at the interfaces.

Removal of all power buses is another way to trigger the A-DCS Off Mode.

Note : Handling of measurement data may be switched off immediately after emergency signal reception by the NIU.

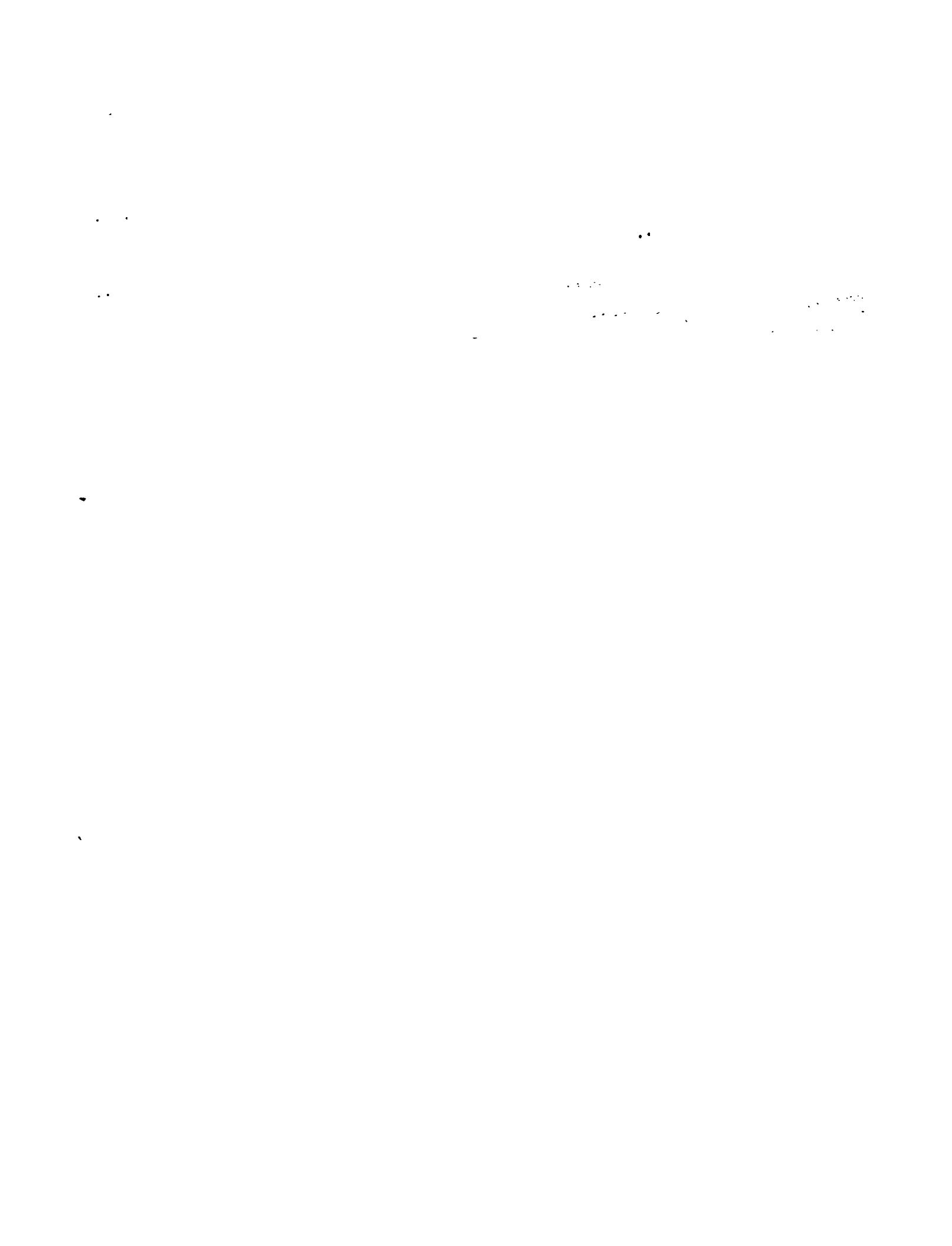
153. Instrument Sequences to A-DCS Mission Mode

The A-DCS instrument switch-on sequence from Off Mode into Mission Mode shall be as following. The temperature constraints are presented in § 2.3.2.2.

Remark : this sequence is also applicable after an emergency sequence to Off Mode triggered by the removal of all power **buses**.

Instrument Initialization

- 1) TBD_{ADCs}



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2.13. Instrument Reference Frame

The reference point for all mechanical and thermal data for each of the units are shown in the Interface Control Drawings (at the interface to the PLM structure, see § 2.1.4).

The A-DCS instrument RPU and TXU Unit Interface Reference Frames, $F_{ADCS-RPU}$, $F_{ADCS-TXU}$, with the origin being at the reference point, is as defined in the Mechanical Interface Control Drawings (See § 2.1.4.1.X).

2.1.4. Interface Drawings

2.1.4.1. Mechanical Interface Drawing

The A-DCS instrument RPU and TXU unit configurations and mechanical interfaces are illustrated in the following interface drawings :

- A-DCS RPU **Interface** Control Drawing

Ref. TBD_{ADCS} , (reference is 8212-200E380, Issue 10, dated December 1990)

- A-DCS TXU Interface Control Drawing

Ref. TBD_{ADCS} , (reference 8212-300E380, Issue 9, dated December 1990)

These drawings are illustrated in **the following pages**. Till the release of proper drawings, these are representative for dimensions (overall envelope), **footprint** and **connector** faces.

2.1.4.2. Thermal Interface Drawing

The A-DCS instrument RPU and TXU unit thermal interfaces are illustrated in TBD_{MET} .

2.1.4.3. Field of View Interface Drawing

Not applicable for A-DCS.

2.2. MECHANICAL INTERFACE DESCRIPTION

2.2.1. Physical Envelope

The A-DCS comprises two separate units that are internally mounted within the METOP PLM. They can be accommodated in any direction on their (length x width) baseplate. The maximum harness length between the A-DCS units is 2 metres.

The maximum harness length allowed between A-DCS units is limited by their electrical performance requirements as defined for the harness. (see § 3.7.). Its mechanical configuration is TBD_{MET} (90 deg. bending configuration shall be possible up to TBD_{MET} places).

The external unit dimensions to a tolerance of ± 1 mm are :

A-DCS	Length (u)	Width (v)	Height (w)
Receiver and Power unit (RPU)	365 mm	280 mm	195 mm
Transmitter Unit (TXU)	310 mm	280 mm	195 mm

Dimensions include mounting lug and connector envelopes.

2.2.2. Field of View Definition

This ICD covers only the accommodation of the A-DCS electronic units. Antenna and antenna patterns are covered in RD2. Therefore field of view requirements are not applicable.

2.2.3. Mass Properties

The mass properties of the A-DCS units are given in the following tables. The co-ordinate system used is the Instrument Interface Reference Frame for each unit, i.e. $F_{ADCS-RPU}$ and $F_{ADCS-TXU}$.

2.2.3.1. Mass and Centre of Mass Location

The A-DCS unit centre of mass locations have been measured without the attachment bolts and washers.

A-DCS	Specified Mass	Centre of Mass Location With Respect to the Reference Point (± 0.5 mm)		
		$U_{ADCS-UNIT}$	$V_{ADCS-UNIT}$	$W_{ADCS-UNIT}$
RPU	16.0 kg	- 161.5 TBC _{ADCS}	- 133.3 TBC _{ADCS}	+ 88.7 TBC _{ADCS}
TXU	8.0 kg	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}
Inter-Unit Harness	TBD _{ADCS} kg			
TOTAL	24.0 kg	(without harness)		

2.2.4. Instrument Mounting Attachments

2.2.4.1. Mounting Description

The A-DCS units are conductively coupled to the inside surface of the PLM.

The following table describes the instrument mounting hardware :

Module/Unit A-DCS	Bolt Size	Instr. Mounting Hole Diameter (mm)	Length (mm)	Torque (Nm)	Quantity
RPU	M4	5.5	TBD _{MET}	TBD _{MET}	14
TXU	M4	5.5	TBD _{MET}	TBD _{MET}	12

Tolerances are specified in the interface drawings (see § 21.4.).

2.2.4.2. Mounting Hole Position and Reference Point (Hole)

The definition of the mounting holes and the instrument Reference Bolt for A-DCS RPU and TXU are given in the Mechanical Interface Control Drawing (see § 21.4.).

2.2.4.3. Mounting Surfaces

RPU and TXU Side	Surface Coplanarity	0.13 mm
	surface roughness of attachment face	≤ 1.6 microns R.A.
	Total area of the mounting surface	conductively coupled using thermal filler (see § 2.3.4.1).
METOP Side	Surface Flatness	Less than 0.1 mm in 100 mm
	Surface roughness of attachment face	≤ 1.6 microns R.A.
	Shimming Accuracy for Flatness	N/A

2.2.4.4. Instrument Location

The mounting surface for the A-DCS RPU and TXU units is TBD_{MET} within the PLM

2.2.4.5. Materials

RPU and TXU Side	Unit Baseplate	Aluminum (detailed alloy : TBD _{ADCS})
	Unit Mounting Area Finish	Alodine 1200
METOP Side	PLM Structure	Aluminium skin with a honeycomb core
	Attachment Bolts and Washers	Titanium bolts with stainless steel washers

2.2.4.6. Thermo-Elastic Interface

Not applicable for A-DCS.

2.2.8. Interface Structural Design

For METOP, design loads (**qualification** loads) are specified as follows : **Design Loads = 1.25 x Flight Limit Loads**

For acceptance purpose, acceptance loads shall be used based on Flight Limit Loads or loads derived from coupled analysis, whichever loads are higher.

2.2.8.1. Maximum Flight Limit Loads

Flight Limits Loads are enveloping the loads, including launch, manufacturing, handling, transportation and ground testing (excluding qualification testing).

The maximum allowable flight limit loads at the instrument interface attachments to the PLM structure are the following :

The A-DCS **units** shall be designed against a quasi **static** design load of **40 g** applied for dimensioning :

- at the unit COG
- in ally spatial direction

2.2.8.2. Safety Factors

Safety factors shall account for **inaccuracies** in predicted allowable **and applied** stresses or loads due to analysis **uncertainties, manufacturing tolerances, scatter in material properties, setting interface**.

Safety factor shall be applied on top of the 'Flight Limits Loads and are given in the following table:

Components/Load Cases	Minimum Factors of Safety		
	Proof (a)	Yield (b)	Ultimate
General Structure. Metallic			
• Verified by Analysis and Test	-	1.1	1.5
• Verified by Analysis only 8	-	1.25	2.0
Non-Metallic Structures			
• Verified by Analysis and Test	1.2 (d)		-1.5
• Verified by Analysis only (b)	-		2.0
Actuating Device Cables	2.0	-	3.0

a) Proof factor applies to Flight Limit Loads

b) In case of structural qualification tests performed **on** potential flight hardware, **the** yield **FoS** shall be equivalent to the states Ultimate **FoS**.

c) Use **of this** option requires prior approval by **ESA**

d) No yielding is permitted at Roof Load

2.3. THERMAL INTERFACE DESCRIPTION

2.3.1. Thermal Control Concept

The A-DCS RPU and TXU units are category B units. The instrument is responsible for the unit internal thermal design. The control of the external thermal environment for these units is under the responsibility of the METOP PLM.

23.1.1. Thermal Control During Nominal Operations

The nominal operations correspond to the A-DCS Mission Mode.

During these modes, the instrument unit temperature is controlled by passive design supplemented by heaters. The METOP provided heaters and temperature sensors are mounted externally to the units.

23.1.2. Thermal Control During Non Nominal /Contingency Operations

The non nominal / contingency mode corresponds to the A-DCS Off Mode.

During this mode, METOP provided heaters are used to maintain non-operational temperatures and are controlled using internal thermostats. Those are external to the A-DCS units.

23.2. Instrument Thermal Requirements

23.2.1. Instrument Temperature Range

23.2.1.1. On-Orbit Temperature Range

Instrument internal temperatures will fall within instrument design limits as long as the interface temperatures as defined in § 23.2.2. are maintained.

23.2.1.2. Ground Testing Temperature limits

The interface temperatures as defined in § 23.2.2. shall not be exceeded during ground tests.

The minimum operational temperature of -5 deg. C can be reduced down to -10 deg. C with reduced instrument performances.

23.2.1.3. Ground Storage and Transportation Temperature Range

During ground storage, with the instrument installed on the satellite, and during transportation of the complete spacecraft, the temperatures of the instrument will be maintained in the range :

-30 to + 60deg. C

233. **Thermal** Control Budgets

233.1. Heater Power Budgets

Not applicable for **A-DCS**.

233.3. **Instrument Thermal Dissipation**

The dissipation of the A-DCS instrument is constant throughout the orbit and is (see § 3.4.2) :

A-DCS Thermal Dissipation (Watts)				
Satellite Nominal Operating Modes				Safe Mode
Minimum Dissipation		Maximum Dissipation		min / Max.
RPU	Operating Mode	Off Mode	Operating Modes	Off Mode
	BOL	EOL	EOL	EOL
RPU	40	0	40	0
TXU	d/20	0	0 / 20	0
TOTAL	40 / 60	0	40 / 60	0

233.3. Heat Exchange Budgets

The A-DCS units are conductively coupled to the **METOP PLM**

2.3.3.3.1. Conductive Heat Transfer Budget

Not applicable for A-DCS.

2.3.3.3.2. **Joint Characteristics**

The A-DCS units are conductively coupled to the **inside** of the **PLM** panel using thermal filler.

2.3.3.3.3. Radiative Heat Transfer Budget

This section is not **applicable** to A-DCS.

2.3.4.2.2. Thermo-Optical Properties

The A-DCS unit surfaces are black painted.

The thermo-optical properties of the finishes are given in the following table :

#	Acronym	Surface / Material	Solar Absorptance		IR
			BOL	EOL * 5yr.	
1	CHM306TTT	Black Paint Chemglaze Z306	0.95	0.95	0.95

* : these values are not normally applicable but are required for the modelization (ESARAD).

A-DCS *Material Thermo-Optical Properties*

23.43. Thermal Heat Capacity

Unit	No d e	Thermal Heat Capacity (J/K)
RPU	N1	TBD _{ADCs}
TXU	N1	TBD _{ADCs}

23.4.4. Instrument Temperature Measurement

This section is not applicable for A-DCS.

23.45. Heater Definition

This section is not applicable for A-DCS

23.4.6. Thermal Interface Models

Required Model for A-DCS : No

**3. COMMAND AND CONTROL, MEASUREMENT DATA,
ELECTRICAL, EMC **AND RFC** INTERFACE DESCRIPTION**

3.1. ELECTRICAL INTERFACE OVERVIEW

The avionics interface between the METOP Payload Module (PLM) and the A-DCS ~~instrument~~ is handled via the Power Conditioning Unit (PCU) and the NOAA Interface Unit (NIU). The thermal control is provided by the Thermal Control Unit.

The A-DCS receives RF data from the RF Filter (RFF - Accommodation Hardware).

The A-DCS provides RF output data to the DCS Transmit Antenna (DTA).

For adaptation of the single ended interfaces of A-DCS, a special grounding concept is described in § 3.8 (EMC).

The command and housekeeping budget for the instrument is as follows :

- 15 pulse discrete commands
- 7 level discrete commands
- 16 digital B telemetry parameters, each 1 bit
- 20 analog telemetry parameters, each to be converted to 8 bits within NIU.

Figure 3.1-1 gives an overview on the electrical interfaces between PLM, RFF, DTA and A-DCS as well the A-DCS internal interfaces between RPU and TXU.

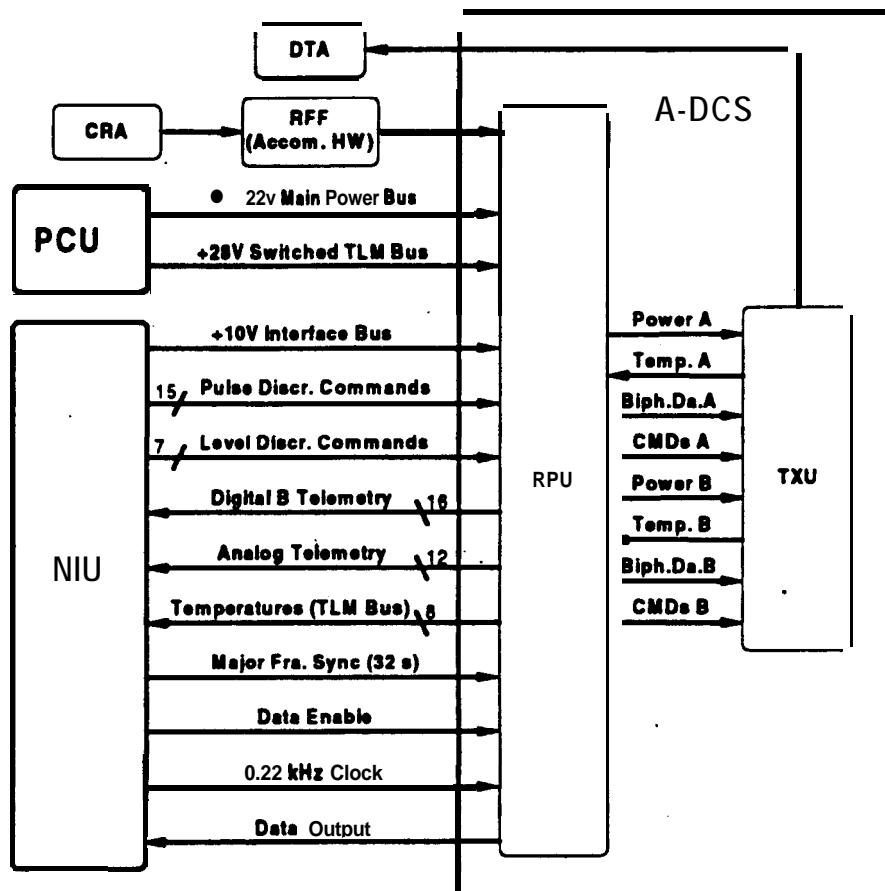


Figure 3.1-1 : A-DCS Electrical Interface Overview

Any pulse ON condition may last for considerable time in case of a spacecraft anomaly. The instrument shall not be damaged by such an occurrence.

The METOP satellite will provide capabilities for pre-programming of the A-DCS of up to 36 hours. The instrument shall cope with this pre-programming period, and not require any intermediate command and control process.

The commands to operate the instrument shall be as listed in Table 3.2.2-1.

Note : The operational modes and sequences of commanding are defined in § 1.4 and 1.5.

3.2.2.1. Telecommand Definition

The satellite shall provide to the instrument all commands which are listed in Table 3.22-1.

Nr.	Telecommand	Mnemo	Type	Remarks
1	DCS Pulse CMD 1		Pulse	
2	DCS Pulse CMD 2		Pulse	
3	DCS Pulse CMD 3		Pulse	
4	DCS Pulse CMD 4		Pulse	
5	DCS Pulse CMD 5		Pulse	
6	DCS Pulse CMD 6		Pulse	
7	DCS Pulse CMD 7		Pulse	
8	DCS Pulse CMD 8		Pulse	
9	DCS Pulse CMD 9		Pulse	
10	DCS Pulse CMD 10		Pulse	
11	DCS Pulse CMD 11		Pulse	
12	DCS Pulse CMD 12		Pulse	
13	DCS Pulse CMD 13		Pulse	
14	DCS Pulse CMD 14		Pulse	
15	DCS Pulse CMD 15		Pulse	To execute the Level Discrete CMDs
16	(DCS Level CMD 1		Level	
17	DCS Level CMD 2		Level	
18	DCS Level CMD 3		Level	
19	DCS Level CMD 4		Level	
20	DCS Level CMD 5		Level	
21	DCS Level CMD 6		Level	
22	DCS Level CMD 7		Level	

Table 3.2.2-1 : Telecommand Definition

8) DCS Pulse CMD 8

TBD_{ADCs}

9) DCS Pulse CMD 9

TBD_{ADCs}

10) DCS Pulse CMD 10

TBD_{ADCs}

11) DCS Pulse CMD 11

TBD_{ADCs}

12) DCS Pulse CMD 12

TBD_{ADCs}

13) DCS Pulse CMD 13

TBD_{ADCs}

14) DCS Pulse CMD 14

TBD_{ADCs}

15) DCS Pulse CMD 15

TBD_{ADCs}

16) DCS Combined Level CMD 1

TBD_{ADCs}

15+n) DCS Combined Level CMD n

TBD_{ADCs}

3333. Digital B Telemetry

The instrument shall provide the Digital B telemetry as listed in Table 3.2.3-i.

The Digital B telemetry points shall be defined as following :

- ### **1.) ADCS Digital B TLM I**

TBD_{APCS}

- ### **2.) ADCS Digital B TLM 2**

TBD_{ADCS}

- ### 3.) ADCS Digital B **TLM** 3

TBD_{ADCS}

- #### 4.) ADCS Digital B **TLM** 4

TBD_{ADCS}

- ### 5.) ADCS Digital B **TLM** 5

TBD_{ADCS}

- 6.) ADCS Digital B **TLM** 6

TBD_{ADCS}

- 7.) ADCS Digital B **TLM** 7

TBD_{ADCs}

- 8.) *ADCS Digital B TLM* 8

TBD_{ADCS}

- ### 9.) ADCS Digital B **TLM** 9

TBD_{ADCS}

- ### 10.) ADCS Digital B **TLM** JO

TBD_{ADCS}

- 11.) **ADCS Digital B TLM 11**

TBD_{ADCS}

- 12.) ADCS Digital B **TLM** 12

TBD_{ADCS}

- 13.) ADCS Digital B **TLM** 13

TBD_{ADCS}

Following are the Digital B Telemetry status as function of the different telecommands :

Nr.	Telecommand	Digital B Telemetry Status	Timing
<i>Pulse Commands</i>			
1	DCS Pulse CMD 1	TBD _{ADCs}	TBD _{ADCs}
2	DCS Pulse CMD 2	TBD _{ADCs}	TBD _{ADCs}
3	DCS Pulse CMD 3	TBD _{ADCs}	TBD _{ADCs}
4	DCS Pulse CMD 4	TBD _{ADCs}	TBD _{ADCs}
5	DCS Pulse CMD 5	TBD _{ADCs}	TBD _{ADCs}
6	DCS Pulse CMD 6	TBD _{ADCs}	TBD _{ADCs}
7	DCS Pulse CMD 7	TBD _{ADCs}	TBD _{ADCs}
8	DCS Pulse CMD 8	TBD _{ADCs}	TBD _{ADCs}
9	DCS Pulse CMD 9	TBD _{ADCs}	TBD _{ADCs}
10	DCS Pulse CMD 10	TBD _{ADCs}	TBD _{ADCs}
11	DCS Pulse CMD 11	TBD _{ADCs}	TBD _{ADCs}
12	DCS Pulse CMD 12	TBD _{ADCs}	TBD _{ADCs}
13	DCS Pulse CMD 13	TBD _{ADCs}	TBD _{ADCs}
14	DCS Pulse CMD 14	TBD _{ADCs}	TBD _{ADCs}
15	DCS Pulse CMD 15	TBD _{ADCs}	-
<i>Level Commands (combined)</i>			
16	DCS Combined Level CMD 1	TBD _{ADCs}	TBD _{ADCs}
:	:	:	:
15+n	DCS Combined Level CMD n	TBD _{ADCs}	TBD _{ADCs}

Table 3.2.3-J : Instrument Digital B Telemetry vs. Commands

II.) ***DCS Analog TLM 3*****TBD_{ADCs}**12.) ***DCS Analog TLM 4*****TBD_{ADCs}**13.) ***DCS Analog TLM 5*****TBD_{ADCs}**14.) ***DCS Analog TLM 6*****TBD_{ADCs}**15.) ***DCS Analog TLM 7*****TBD_{ADCs}**16.) ***DCS Analog TLM 8*****TBD_{ADCs}**17.) ***DCS Analog TLM 9*****TBD_{ADCs}**18.) ***DCS Analog TLM 10*****TBD_{ADCs}**19.) ***DCS Analog TLM 11*****TBD_{ADCs}**20.) ***DCS Analog TLM 12*****TBD_{ADCs}**

The analog telemeny shall have the performance as defined in Table 3.2.3-2. The transfer function between physical range and voltage range is part of the deliverables / as-built data.

Following are the Analog Telemetry status as function of the different telecommands :

Nr.	Telecommand	'Analog Telemetry Status	Timing
<i>Pulse Commands</i>			
1	DCS Pulse CMD 1	TBD _{ADCs}	TBD _{ADCs}
2	DCS Pulse CMD 2	TBD _{ADCs}	TBD _{ADCs}
3	DCS Pulse CMD 3	TBD _{ADCs}	TBD _{ADCs}
4	DCS Pulse CMD 4	TBD _{ADCs}	TBD _{ADCs}
5	DCS Pulse CMD 5	TBD _{ADCs}	TBD _{ADCs}
6	DCS Pulse CMD 6	TBD _{ADCs}	TBD _{ADCs}
7	DCS Pulse CMD 7	TBD _{ADCs}	TBD _{ADCs}
8	DCS Pulse CMD 8	TBD _{ADCs}	TBD _{ADCs}
9	DCS Pulse CMD 9	TBD _{ADCs}	TBD _{ADCs}
10	DCS Pulse CMD 10	TBD _{ADCs}	TBD _{ADCs}
11	DcsPulseCMD11	TBD _{ADCs}	TBD _{ADCs}
12	DCS Pulse CMD 12	TBD _{ADCs}	TBD _{ADCs}
13	DcsPulseCMD13	TBD _{ADCs}	TBD _{ADCs}
14	DCS Pulse CMD 14	TBD _{ADCs}	TBD _{ADCs}
15	DCS Pulse CMD 15	TBD _{ADCs}	TBD _{ADCs}
<i>Level Commands (combined)</i>			
16	DCS Combined Level CMD 1	TBD _{ADCs}	TBD _{ADCs}
	:		:
15+n	DCS Combined Level CMD n	TBD _{ADCs}	TBD _{ADCs}

Table 3.2.3-3 : Instrument Analog Telemetry vs. Commands

3.3. MEASUREMENT DATA TRANSFER FUNCTIONAL DESCRIPTION

33.1. Data Rate

Every 100 ms, the NIU acquires 93 8-bit words from the A-DCS. Hence an apparent data rate of 7440 bits per second.

These data are not packetized within the instrument.

33.2. Measurement Data Acquisition

The measurement data shall be acquired via the digital A data interface.

The interface shall consist of the :

- Data Enable pulse line
- Data Clock line
- Data Line.

The A-DCS serial data are clocked into the NIU at a bit rate of 8.32 kbps by means of the data clock whenever the data enable pulse is presented to the instrument

Both clock and enable pulse shall be delivered by the NIU.

The acquisition shall comply with Figure 3.3.2-1.

TBD_{ADCs} 8-bit A-DCS data are stored internally of the instrument within a memory buffer. The data is considered as a byte stream independent on internal message format. The first data word of a 32 second cycle will be available for readout Td_{DCS} after start of the respective cycle (refer to Figure 3.3.2-1a).

Td_{DCS} defines the start of the Data Enable pulse relative to the start of the 0.1 seconds (NIU internal) cycle.

Td, shall be $(66 \cdot 8 * T_{8.32k} + 2 * T_{8.32k} / 5)$. T_{8.32k} is the time period of the 8.32 kHz Clock (CLU).

Note: Td_{DCS} is approximately 63.51 ms $\pm 10^{-4}$

During the (continuous) data acquisition the Data Enable pulse shall repeat after Ts_{DCS}. Ts_{DCS} shall be $8 \cdot T_{8.32k}$.

Note: Ts_{DCS} is approximately 961.5 μ s $\pm 10^{-4}$

The words shall be separated by a gap in the Data Enable pulse acc. to Figure 3.3.2-1b.

The 8.32 kHz Clock is derived from a free running oscillator in the NIU. The Major Frame Sync.(32 s) is derived in the NIU from the OBDH Bus Broadcast Pulse. The OBDH Bus Broadcast Pulse is generated by the oscillator in the CCU on the Service Module. The leading edge of the 32 s Pulse will be phase correlated to the 8.32 kHz Clock

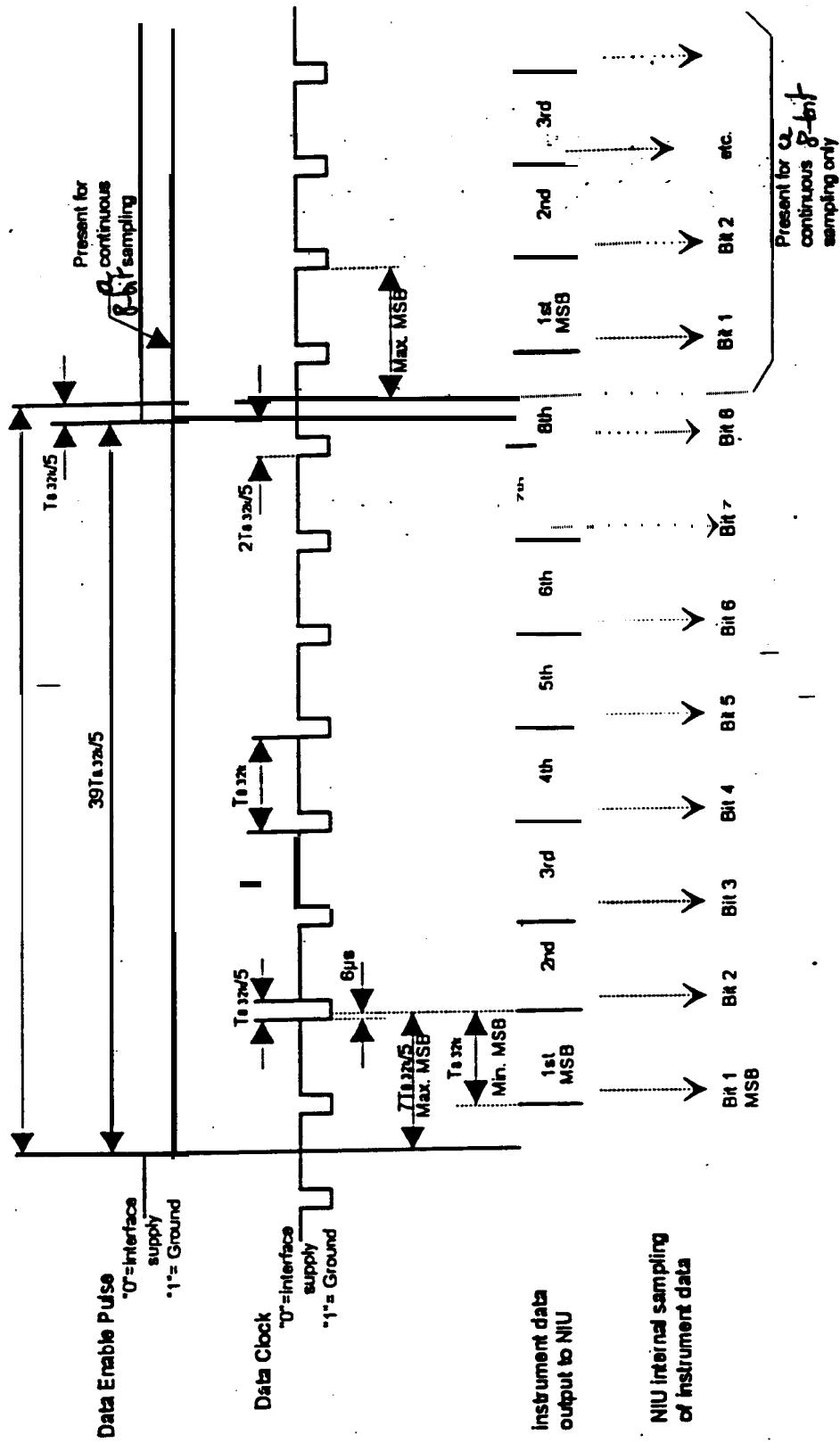


Figure 3.3.2-1b : A-DCS Measurement Data Acquisition Detailed Timing

Bit	0	1	2	3	4	5	6	7		
Word0	D						6			
	(Synchronization Word - D60 HEX)									
word1	0			0			DRU Number (1)			
	(Sync.)									
Word 2	Sensor Number (2)			Parity (3)		MSB	Level 3/6 (4)			
Word 3	Level 3/6 (4)		LSB	MSB		Time 5/20 (5)				
Word 4	Tii 8/20 (5)									
Word 5	Time 7/20 (5)						LSB	Parity (6)		
Word 6	ID 8/20 (7)									
Word 7	ID 8/20 (7)									
Word 8	ID 4/20 (7)			0	0	0	I	0		
Word 9	Sensor Group 1 Word 1 (8)									
Word 10	Sensor Group 1 Word 2 (8)									
Word 11	Sensor Group 1 Word 3 (8)									
Word 12	Sensor Group 1 Word 4 (8)									
	4 to 4x8 Sensor Words									
Word N-2	MSB			Doppler 8/23 (9)						
Word N-1	Doppler 8/23 (9)									
Word N	Doppler 8/23 (9)					LSB	Parity (10)			

Notes : see Figure 3.3.3/3.

Figure 3.3.3/1 : A-DCS Message Data Format

(1)	DRU Number - 3 bits defining DRU coded as follows : TBD_{ADCs}
(2)	Number of Sensor Groups - 4 bits identifying the number of sensor words in the message. Each sensor group requires four data words, therefore, the number of sensors determines the message length. The 4 bits are coded as follows : TBD_{ADCs}
(3)	Parity : 1 bit even parity of the previous eight bits
(4)	Level - 6 bits containing RF level information. The level (in dBm) is determined by the expression : $L = -140 + 05644.N$ (where N is the decimal equivalent of the 6 level bits)
(5)	time Code - 20 bits containing the time of the message transmission ; 20 ms per bit. TBC_{ADCs}
(6)	Parity : 1 bit even parity of the previous 20 time code bits
(7)	ID - 20 bits defining... TBD_{ADCs} Under testing, those 20 bits are : Word 6 FF word7 FF Word 8 Bits 0-3 Platform Simulator Number, as follows : TBD_{ADCs}
(8)	Sensor Word ... TBD_{ADCs} During tests, the test patterns are as follows : Word 9 00 FF Word 10 FF or FF word11 55 FF word12 AA FF
(9)	Doppler - 23 bits containing the frequency of the message. The frequency is computed as follows : $F = (N / 2^{23}) \times 10^6$ Hz (where N is the decimal equivalent of the 23 Doppler bits) TBD_{ADCs}
(10)	Parity : 1 bit even parity of the previous 23 Doppler bits

Figure 3.3.3/3 : Notes to the A-DCS Message Data Formats

MATRA MARCONI SPACE

A-DCS

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Date : June 12th 1998
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TBD_{ADCs}

Table 3.4.2-1 : Power Consumption Data Sheet (1/2)

		dP/dV @ 25 deg. C														
Instr. Mode	Power Bus	Typical Beginning of Life (W)							Worst Case End of Life (W)							Failure Power
		Mean Power	Min. Power	Max. Power	Peak Power	Peak Duration	Peak Cycle	Duty Cycle	Mean Power	Min. Power	Max. Power	Peak Power	Peak Duration	Peak Cycle	Failure Power	
Off Mode	28 V Main Bus	0	-	-	-	-	-	-	0	-	-	-	-	-	-	
	28VSwilchedTMBus	0.04 ³	-	-	0 /	-	-	-	0 /	-	-	-	-	-	-	
	10 V Interface Bus	0	-	-	-	-	-	-	0	-	-	-	-	-	-	
	TOTAL	0 /	-	-	-	-	-	-	0 /	-	-	-	-	-	-	
Mission Mode: Stand-By (Turn-On)	28 V Main Bus	21.75	TBC _{DCS}					22.40	TBC _{DCS}						-	
	28 V Switched TM Bus	00.04						00.08							-	
	10 V Interface Bus	00.01						00.02							-	
	TOTAL	21.80						22.50							-	

³ In Off Mode, the power consumption on the Switched Temperature Telemetry bus is 0.04 W when lb& bus is available at the instrument interface. Otherwise it is 0 W.

3.43. Power Electrical Interface Requirements

In order to structure the electrical interfaces, all signals to be controlled by this document will be identified and classified into a certain number of signal types. For each signal type a three character identifier code is given as defined in the corresponding tables.

Table 3.4.3-1 shows the power interfaces used by the A-DCS and the corresponding data sheet identifiers.

	Data Sheet Code	Interface Circuit
+28 V Main Power Bus DCS	APB	Fig. 3.4.3.2-1
+28 V Switched TLM Bus DCS	BPB	Fig. 3.4.3.2-2
+10 V Interface Bus DCS	DPB	Fig. 3.4.3.2-3

Table 3.4.3-1 : A-DCS Power Interfaces

Within the Power Interface Data Sheets in § 3.4.3.1 the electrical characteristics of the power interfaces are defined.

3.43.1. Power Interface Data Sheets

On the following pages the electrical characteristics of the power interfaces are defined with one Data Sheet per signal. In Table 3.4.3-1 : 'A-DCS Power Interfaces' and § 3.4.5 Power Pin Allocation Lists' is referenced to these Data Sheets.

The performances specified in the Data Sheets are maintained during the mission lifetime and under nominal load and temperature range conditions. Source specifications have to be measured at the connector of the source and load specifications have to be measured at the connector of the load unless specified otherwise.

Parameter Definitions

Small Signal Impedance

Output impedance of the power supply tested with, compared to 28V, small AC signals.

Output Impedance

Linear output impedance of the power supply.

Voltage Ripple

Sinusoidal voltage ripple., including repetitive spikes and voltage drop caused by the instruments current ripple.

Under- Voltage. (incl. ripple & trans.)

The specified voltage range will be considered as under-voltage.

Signal Nomenclature		28 V Main Power Bus
Code		APB
EMC Class		Power
Power Source Specification		
Parameter	Requirement	Remarks
Voltage	27.16 ... 28.84 V	at A-DCS input
Small Signal Impedance	< 0.3 Ω	f < 100 kHz, short circuit protection & line < 0.1Ω
Voltage Ripple	See 9'4.3.1.2	
Under-Voltage (incl. ripple & trans.)	> 16 V ; < 27.16 V	for < 3 s
Over-Voltage (incl. ripple & trans.)	> 28.84 V ; < 38.0 V	for < 50 ms
Transients	See § 4.3.1.2	
Max. Current	< 5.0 A	Limited by short circuit protection
Leakage Current	< 6 mA	Short circuit protection 'Off'
Load Specification		
Parameter	Requirement	Remarks
Max. Steady-State Current	2.3 A	
Current Ripple	< 2% Max Steady-State Curr.	f < 100 kHz
Inrush Current:	< 150% Max. Steady-State Curr.	Steady- State after 6 ms
inrush Current Rate	< 30 mA/μs	
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 20. T4	

Signal Nomenclature		+28 V Switched TLM Bus
Code		BPB
EMC Class		Power
Power Source Specification:		
Parameter	Requirement	Remarks
Voltage	27.16 . . . 28.84 V	at A-DCS input ⁴
Small Signal Impedance	< 160 Ω	f < 100 kHz
Voltage Ripple	See § 4.3.1.2	
Under-Voltage (incl. ripple & trans.)	> 16.00 ; < 27.16 V	for < 3 s
Over-Voltage (incl. ripple & trans.)	> 28.84 ; < 38.00 V	for < 50 ms
Transients	See § 4.3.1.2	
Load Specification		
Parameter	Requirement	Remarks
Max. Steady-State Current	2 mA	
Current Ripple	< 1 mA _{pp}	f < 100 kHz
Inrush Current	< 150% of Max. Steady-State Curr.	Steady-State after 30 ms
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24. TP	

⁴ Measured under no load condition.

Over-Voltage (incl. ripple & trans.)

The specified voltage range will be considered as over-voltage.

Transients

Positive or negative going, non repetitive spikes caused by load current changes.

Max. Steady-State Current

Maximum power as defined in the Power Consumption Data Sheet, divided by the minimum specified nominal voltage.

Current Ripple

Ripple caused by the load pulsed currents (DC/DC converter, stepper mans...).

Inrush Current

Maximum allowed input current for a restricted time, when the load is switched on.

Inrush Current Rate

Rate-of-change of the input current over time when the load is switched 'on'.

Table 3.4.2-I : Power Consumption Data Sheet (2/2)

A-DCS		Typical Beginning of Life (W)							Worst Case End of Wfe (W)						
Instr. Mode	Power Bus	Mean Power	Min. Power	Max. Power	Peak Power	Peak Duration	Peak Duty Cycle	Mean Power	Min. Power	Max. Power	Peak Power	Peak Duration	Peak Duty Cycle	Failure Power	
Mission Mode	28 V Main Bus	63.50						63.50							
	28 V Switched TM Bus	00.04						00.08							
	10 V Interface Bus	00.01						00.02							
	<i>TOTAL</i>	63.55						63.60							
Mission Mode: Receiving Only	28 V Main Bus	39.30						39.30							
	28 V Switched TM Bus	00.04						00.08							
	10 V Interface Bus	00.01						00.02						
	<i>TOTAL</i>	39.35						39.40							

3.4.2. Power Demand

The actual power demands for the A-DCS on the individual power busses for BOL & EOL during all modes and required outlet dimensions are defined in Table 3.4.2-1 Power Consumption Data Sheet..

The heater power for the A-DCS units is not an instrument electrical interface and therefore not dealt within the following table.

Definitions

Typical Beginning of Life Power

Power expected to be measured during instrument acceptance test, = basic power.

Worst Case End of Life Power

Specified power the instrument shall never exceed (except in case of failure).

Mean Power

Steady state power consumed when the power bus is set at its mean voltage and with a 25 deg. C temperature.

Min / Max Power

Min. / max. steady state power consumed as a function of power bus input voltage and instrument temperature.

Peak Power

Total power consumed during a peak, i.e. corresponding to an event of finite duration during the considered functional mode. The peak power is given at mean power bus voltage and with a 25 deg. C temperature. The peak power is characterized by a peak duration and / a peak repetition duty cycle.

Failure Power Consumption

Maximum permanent power that will be consumed without triggering an internal protection or without leading to a fuse blowing.

dP/dV @ 25 deg. C

Mean variation of the consumed power with respect to the input voltage.

3.4. POWERELECTRICAL INTERFACES

3.4.1. Overview

The A-DCS instrument requires the following power interfaces :

- A regulated + 28 V *Main Power Bus* with high power quality as primary source for the instrument.
- A regulated + 28 V *Switched TLM Bus* for powering temperature telemetry.
- A regulated + 10 V *Interface Bus* for the command, clock and measurement data interface circuits.

The +28 V Main Power Bus and the + 28 V Switched TLM Bus are conditioned by the internally redundant Power Conversion Unit (PCU). The +28 V Main Power Bus is individually switched and protected. The +28 V Switched TLM Bus is powered whenever the PCU is on. The +10 V Interface Bus is provided by the NIU. This is illustrated in Fig. 3.4. 1-1.

Fig. 3.4.1-2 gives details of the A-DCS internal power distribution.

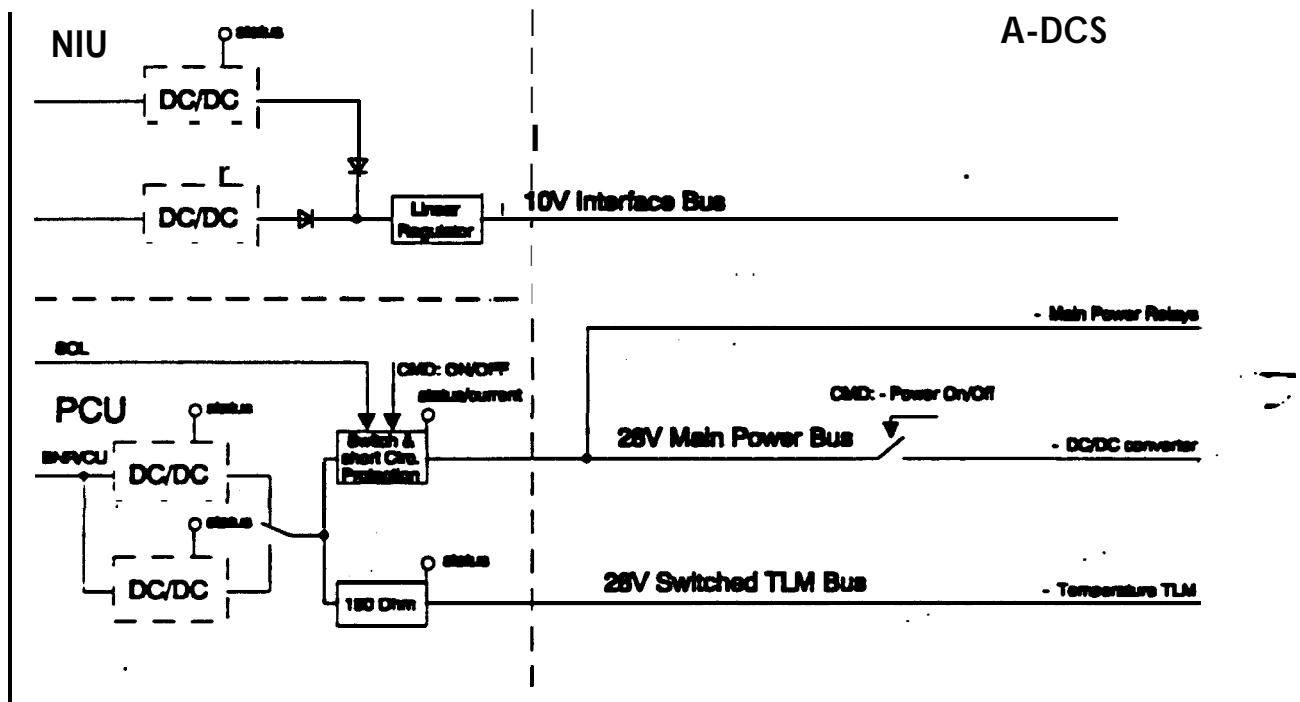


Fig. 3.4.1-1 : A-DCS Power **Distribution** Diagram

Bit	0	I	1	I	2	I	3	4	..	5	..	6	7
Word 0		D								6			
Word 1		0						1				DRU Number (1)	
word2		0						Parity (3)		MSB		Level 3/6 (4)	
Word 3	Level 3/6 (4)		<i>LSB</i>			<i>MSB</i>				Time 5/20 (5)			
Word 4								Time 8/20 (5)					
Word 5							Time 7/20 (5)			<i>LSB</i>		Parity (6)	
Word 6		F							0				
Word 7		F							0				
Word 8		F							0				
Word 9		0								F			
Word 10		0								F			
Word 11		0								F			
Word 12		0								F			
Word 13	<i>MSB</i>							Doppler 8/23 (9)					
Word 14								Doppler 8/23 (9)					
Word 15								Doppler 8/23 (9)		<i>LSB</i>		Parity (10)	

Notes : see Figure 3.3.3/3.

Figure 3.3.3/2 : A-DCS Pseudo-Message Data Format

333. Measurement (Digital A) Data Format

This section is TBC_{ADCs}.

333.1. A-DCS Messages and Pseudo-Messages

The A-DCS instrument receives messages from platforms (balloons, buoys, ships...) and transmits them to the satellite. There are two types of messages: All are identified by a DRU.

DCS Messages

The DCS message structure is based on 8-bit words and illustrated in Figure 3.3.3/1.

Its length varies from 16 to 44 words, depending upon the number of sensors contained in the platform transmission. Each sensor data requires 4 DCS words and the number of sensors varies from a minimum of one to a maximum of eight. The message length accordingly increases by an additional 4 words with each additional sensor in the platform transmission. Hence the possible lengths are : 16, 20, 24, 28, 32, 36, 40 and 44 words.

DCS Pseudo-Messages

The DCS pseudo-message structure is also based on 8-bit words and illustrated in Figure 3.3.3/2.

This structure is the same as for the DCS message, with the exception of the sensor data which are replaced with alternating strings of 1 and 0. The pseudo-message length is fixed at 16 words.

333.3. Data Format at the A-DCS Output

The digital A data acquired by the NIU from the A-DCS follow the format as described in § 3.3.3.1., i.e. the digital A data will consist of a succession of DCS messages and pseudo-messages.

The A-DCS is responsible to buffer the data within the instrument so that the transfer from the A-DCS to the NIU remains within the data rate allocated in § 3.3.1. and the acquisition process constraints described in § 3.3.2

The DCS messages and pseudo-messages shall be transmitted to the NIU, entirely and with no interleaving of message words from other DRUs.

Each of these two oscillators has its own initial setting failure, temperature drift and ageing. This will result in a tolerance of the number of clocks per Sync. Pulse period as depicted in Table 3.3.2.-1. The specified tolerances are the maximum tolerances during mission lifetime and over nominal temperature range conditions.

	Sync 0.1s	Sync. 32 sec
No. of 8.32 kHz cycles	832 ± 1 *)	$266.24 * 10^3 \pm 32$

*) Tolerance figure for last (10th) 0.1 s period of a 1 s cycle only. For the 9 first cycles the tolerance figure is ± 0 . The tolerance range does not affect METOP specified data transfer.

Table 3.3.2-I : Sync. Period Tolerances in Numbers of 8.32 kHz Cycles

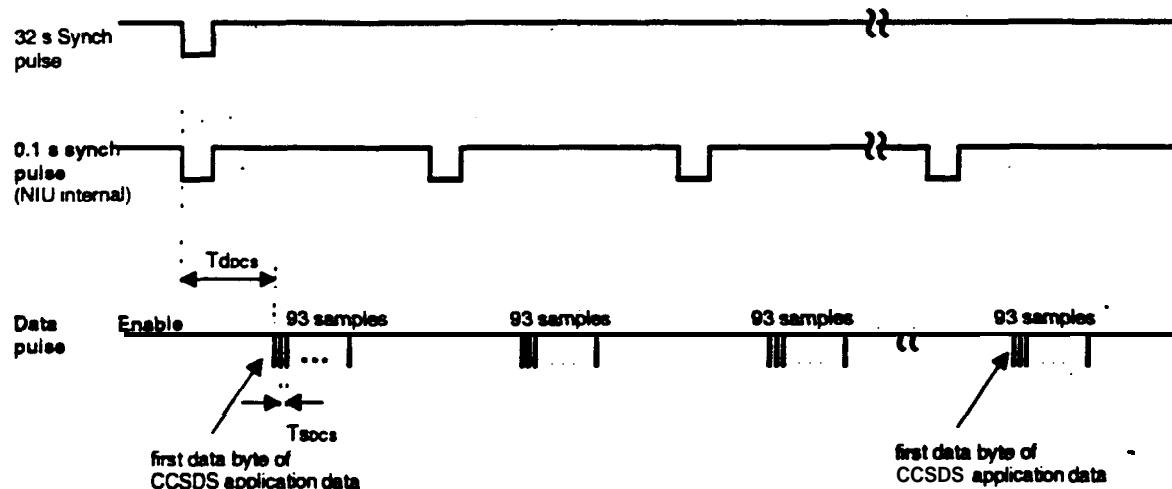


Figure 3.3.2-1a : A-DCS Measurement Data Acquisition Sampling Timing

33.4. Telecommand Verification

The satellite will not perform any compatibility check between commands for the instrument and active instrument operational modes.

No on-board command verification will be performed for the A-DCS.

3.2.5. METOP Specific Thermal Control Electrical Interfaces

Not applicable for A-DCS.

3.2.6. Satellite Services - Synchronization

Note : Satellite Services are defined as all Command and Control tasks which will be performed by the PLM or the SVM to support instrument operations.

Note: the synchronization of measurement data read-out is defined in § 3.3.2.

Synchronization signals : N/A

Nr.	Telemetry Point Name	Physical Range	Remarks
1	DCS Analog Temp. TLM 1	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
2	DCS Analog Temp. TLM 2	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
3	DCS Analog Temp. TLM 3	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
4	DCS Analog Temp. TLM 4	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
5	DCS Analog Temp. TLM 5	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
6	DCS Analog Temp. TLM 6	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
7	DCS Analog Temp. TLM 7	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
8	DCS Analog Temp. TLM 8	-20 to +80 deg. C	Powered by the Analog Temp. TLM Bus
9	DCS Analog TLM 1	TBD _{ADCs}	
10	DCS Analog TLM 2	TBD _{ADCs}	
11	DCS Analog TLM 3	TBD _{ADCs}	
12	DCS Analog TLM 4	TBD _{ADCs}	
13	DCS Analog TLM 5	TBD _{ADCs}	
14	DCS Analog TLM 6	TBD _{ADCs}	
15	DCS Analog TLM 7	TBD _{ADCs}	
16	DCS Analog TLM 8	TBD _{ADCs}	
17	DCS Analog TLM 9	TBD _{ADCs}	
18	DCS Analog TLM 10	TBD _{ADCs}	
19	DCS Analog TLM 11	TBD _{ADCs}	
20	DCS Analog TLM 12	TBD _{ADCs}	

Table 3.2.3-2 : Analog Telemetry

3.2.3.3. Analog Telemetry

The A-DCS provides analog telemetry channels as listed in Table 3.2.3-2 to monitor on ground the health of the instrument. It shall be considered that telemetry of analog voltage and temperature (analog telemetry) will be valid by 1 s after switching-on of instrument telemetry, i.e. TBD_{ADCs} command has been sent.

Eight (8) Analog Temperature Telemetry points shall be available whenever the 28 V Analog Temperature Telemetry Bus is powered and be valid within 1 s after Analog Temperature Telemetry Bus has been commanded ON (independent of A-DCS mode). Those points are defined in Table 3.2.3-2.

Typical valid data ranges and values are shown in Table 3.232

The telemetxy points shall be defined as following:

1.) DCS Analog Temperature **TLM I**

TBD_{ADCs}

2.) DCS Analog Temperature **TLM 2**

TBD_{ADCs}

3.) DCS Analog Temperature **TLM 3**

TBD_{ADCs}

4.) DCS Analog Temperature **TLM 4**

TBD_{ADCs}

5.) DCS Analog Temperature **TLM 5**

TBD_{ADCs}

6.) DCS Analog Temperature **TLM 6**

TBD_{ADCs}

7.) DCS Analog Temperature **TLM 7**

TBD_{ADCs}

8.) DCS Analog Temperature **TLM 8**

TBD_{ADCs}

9.) DCS Analog **TLM I**

TBD_{ADCs}

10.) DCS Analog **TLM 2**

TBD_{ADCs}

14.) ADCS Digital B TLM 14

TBD_{ADCs}

15.) ADCS Digital B TLM 15

TBD_{ADCs}

16.) ADCS Digital B TLM 16

TBD_{ADCs}

Nr.	Telemetry Point Name	State		Remark
		Logic "1" (Low Voltage)	Logic "0" (High Voltage)	
1	DCS Digital B TLM 1	OFF	ON	
2	DCS Digital B TLM 2	OFF	ON	
3	DCS Digital B TLM 3	OFF	ON	
4	DCS Digital B TLM 4	OFF	ON	
5	DCS Digital B TLM 5	OFF	ON	
6	DCS Digital B TLM 6	OFF	ON	
7	DCS Digital B TLM 7	OFF	ON	
8	DCS Digital B TLM 8	OFF	ON	
9	DCS Digital B TLM 9	TBD_{ADCs}	TBD_{ADCs}	
10	DCS Digital B TLM 10	TBD_{ADCs}	TBD_{ADCs}	
11	DCS Digital B TLM 11	TBD_{ADCs}	TBD_{ADCs}	
12	DCS Digital B TLM 12	TBD_{ADCs}	TBD_{ADCs}	
13	DCS Digital B TLM 13	TBD_{ADCs}	TBD_{ADCs}	
14	DCS Digital B TLM 14	TBD_{ADCs}	TBD_{ADCs}	
15	DCS Digital B TLM 15	TBD_{ADCs}	TBD_{ADCs}	
16	DCS Digital B TLM 16	TBD_{ADCs}	TBD_{ADCs}	

Note: All digital B telemetry reads Logic "1" when the A-DCS is OFF.

Table 3.2.3-1: A-DCS Digital B Telemetry

3.23. Housekeeping Telemetry

This section describes the A-DCS Digital B and Analog Telemetry.

333.1. General Requirements

The NIU shall only acquire the instrument-provided digital-B and analog HK data at any time when the instrument is in Mission Mode.

The NIU will read out the following housekeeping telemetry formats from the instrument :

- Analog HK
- Digital HK ("Digital B").

The NIU will sample both analog and digital B housekeeping telemetry, with periods of :

- 16 seconds nominally
- up to 1/8 s for any selected parameter on quest.

Analog data shall be acquired and converted within the NIU to 8 bit digital information with a 5.12 V full scale resolution (LSB = 20 mV).

No instrument housekeeping data shall be monitored by the METOP satellite. The verification of command execution will be performed by the Ground System with Analog Housekeeping and Digital B telemetry points.

Combinations of A-DCS Level Commands (Level Command 1 to Level Command 7) allow the definition of 128 combined commands which are decoded by the A-DCS. These used command combinations are summarized in Table 3.2.2-2. Undefined level commands are ignored by the A-DCS.

Telecommand		Command Line Configuration							Function Enabled	Notes
		LC7	LC6	LC5	LC4	LC3	LC2	LC1		
C1	DCS Combined Level CMD 1								:	
:	:								:	
:									TBD _{ADCs}	
	:								:	
C n	DCS Combined Level CMD n								:	

n : TBD_{ADCs}

Note : the combinations "all zero" and "all one" are forbidden.

Table 3.2.2-2 : **Combined A-DCS Level Commands**

3.233. Telecommand Functional Description

Details on the functions of each A-DCS command are given in this section.

1) DCS Pulse CMD 1

TBD_{ADCs}

2) DCS Pulse CMD 2

TBD_{ADCs}

3) DCS Pulse CMD 3

TBD_{ADCs}

4) DCS Pulse CMD 4

TBD_{ADCs}

5) DCS Pulse CMD 5

TBD_{ADCs}

6) DCS Pulse CMD 6

TBD_{ADCs}

7) DCS Pulse CMD 7

TBD_{ADCs}

3.2. COMMAND AND CONTROL FUNCTIONAL DESCRIPTION

This section describes the command and control concept for the A-DCS Instrument.

'Command and Control' comprises the activities resp. data flows for commanding of the instrument as well as for the acquisition of instrument housekeeping data.

Additionally, the instrument provides an interface of measurement data which is described in § 3.3.

These two data sets are treated separately in the METOP satellite.

Commanding of the instrument and acquisition of instrument housekeeping telemetry is performed under the control of the NOM Interface Unit (NIU). Commands are distributed from the PMC via the PLM OBDH Bus to the NOAA Interface Unit (NIU) which translates or converts the functional and electrical interfaces to NOAA instruments and controls command execution. Vice versa housekeeping data are transferred from the instrument and transmitted to ground.

Three data sets are made available by the instrument :

- Digital A data
- Digital B data
- Analog data

Digital A data are in the above sense 'measurement data' and are handled by NIU. They are not routed via the PLM OBDH Bus to the PMC and not used for housekeeping by the satellite.

Digital B and analog data are housekeeping data. Both are reported to the ground via S-band telemetry.

3.3.1. Protocol

Not applicable for A-DCS.

3.3.2. Telecommands

Telecommands to the instrument shall be provided by the NIU.

The minimum time between two consecutive commands is 100 ps.

The instrument shall be commanded by Pulse Discrete Commands¹ and by Level Discrete Commands².

Pulse Discrete Commands shall be issued to the instrument one command at a time.

¹ Pulse Discrete Command Definition

The pulse discrete command is normally used to change the state of a latching relay in the instrument. An ON or TRUE condition is issued in the form of a pulse to the instrument over a single line.

² Level Discrete Command Definition

The level discrete command presents a ON or TRUE (resp. OFF or FALSE) condition to the instrument full time, until the same command is given to change the state to OFF or FALSE (resp. OFF or FALSE).

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2.4. INSTRUMENT AND DISTURBANCE INTERFACES

This section is not applicable to A-DCS.

2.3.4. Thermal Interfaces

The A-DCS conductive and radiative characteristics are described by a single node model as shown.

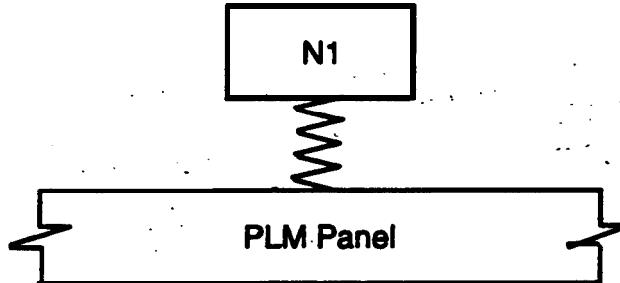


Figure 2.3.4/1 : A-DCS Simplified Interface Model

2.3.4.1. Conductive Interfaces

The thermal conductance between the A-DCS units and the Payload Module is :

A-DCS Units	Node .	Thermal Conductance (W/K)
RPU	N1-PLM	TBD _{ADCS}
TXU	N1-PLM	TBD _{ADCS}

The A-DCS units are conductively coupled to the external surfaces of the PLM. The contact area is defined as the foot print area and is given as :

A-DCS Units	Contact Area (m ²)
RPU	0.0231 TBC _{ADCS}
TXU	0.0216 TBC _{ADCS}

2.3.4.2. Radiative Interfaces

Z-3.4.2.1. Radiative Charactaistics

The A-DCS unit radiator areas are :

Unit	Radiator Area	
	Node	Area (m ²)
RPU	N1	TBD _{ADCS}
TXU	N1	TBD _{ADCS}

A-DCS Unit Radiator Areas

The thermal radiative environment temperature in the hot case is TBD_{MET} deg. C.

2.3.2.2. Temperatures at the Interface

The operating, non-operating and switch-on temperatures for the A-DCS units at the instrument / satellite interface are defined hereafter :

A-DCS Temperatures at the Interface (Deg. C)					
Ref. Point	Operation		Non-Operation		Switch-On
Location	Min.	Max.	Min.	Max.	Min.
RPU	-5'	+45	-30	+60	-10
TXU	-5	+45	-30	+60	-10

The Temperature Reference Point on the instrument baseplate at which these temperatures apply is defined in the drawing TBD_{MET}.

Stability Requirements

There is a thermal stability requirement for the two units in Mission Mode.

Within one orbit period, the maximum allowable temperature variation at the RPU and TXU Temperature Reference Point shall be 10 deg. C peak to peak. The long term mean temperature will fall within the defined operating temperature range.

2.3.3. Radiative Requirements

The surfaces of A-DCS units are black painted except the attachment interfaces.

2.2.8.3. Launch Interface Loads

The A-DCS units 1-g interface loads, calculated at each interface point (zero preload), with the instrument hard-mounted configuration are presented in the following tables (TBD_{ADCS}) :

A-DCS Unit Hard Mounted Interface Loads Based on 1 g Applied in U			
Attachment Id.	Shear Force (N)	Axial Force (N)	Moment (N.mm)
A-DCS RPU			
A-DCS TXU			

A-DCS Unit Hard Mounted Interface Loads Based on 1 g Applied in V			
Attachment Id.	Shear Force (N)	Axial Force (N)	Moment (N.mm)
A-DCSRPU			
A-DCS TXU			

A-DCS Unit Hard Mounted Interface Loads Based on 1 g Applied in W			
Attachment Id.	Shear Force (N)	Axial Force (N)	Moment (N.mm)
A-DCS RPU			
A-DCSTXU			

2.2.8.4. Structural Frequency Characteristics

The A-DCS units have a first frequency above 100 Hz (119 Hz if only analytically determined).

2.2.8.5. Structural Mathematical Models - Applicability for A-DCS

This section is not applicable to A-DCS.

2.2.4.7. Grounding Provisions

The internal units are directly electrically grounded to the PLM structure through its baseplate or a dedicated grounding strap.

The location of the grounding point is bolt position TBD_{ADCS} on the instrument, and is defined in the Mechanical Interface Control Drawing (see § 21.4).

2.2.5. Accessibility

Accessibility to specific parts of the instrument shall be guaranteed, when accommodated on METOP. The faces on which specific parts are accommodated are defined in the following :

A-DCS RPU and TXU			
<i>This table indicates the viewing direction from the instrument.</i>			
	Item	Instrument Side	Access Required
1	Locking Connector covers	± u (RPU) ± u (TXU)	Removed only for bench tests. Reinstalled before assembly on METOP
2	Connector Dust Covers	± u (RPU) ± u (TXU)	Removed prior to connection to METOP
2	Attachment Bolts	- w	During AIT activities

The detailed position of these items are indicated on the Mechanical Interface Control Drawings (2 . 1 . 4 .) .

2.2.6. On-Ground Alignment

Not applicable for A-DCS.

2.2.7. Deployment **Mechanisms and Pyros**

2.2.7.1. Deployment **Mechanisms**

Not applicable for A-DCS.

2.2.7.2. **Pyros**

Not applicable for A-DCS.

The A-DCS units shall not exceed the above specified mass for the METOP mission.

The A-DCS mass shall be measured at $\pm 0.1\%$.

The A-DCS (best estimate) mass is (for information only):	RPU	15.0 kg
	TXU	7.0 kg
	Harness	TBD _{ADCS}
	Total	22.0 kg

2.2.3.2. Moments of Inertia

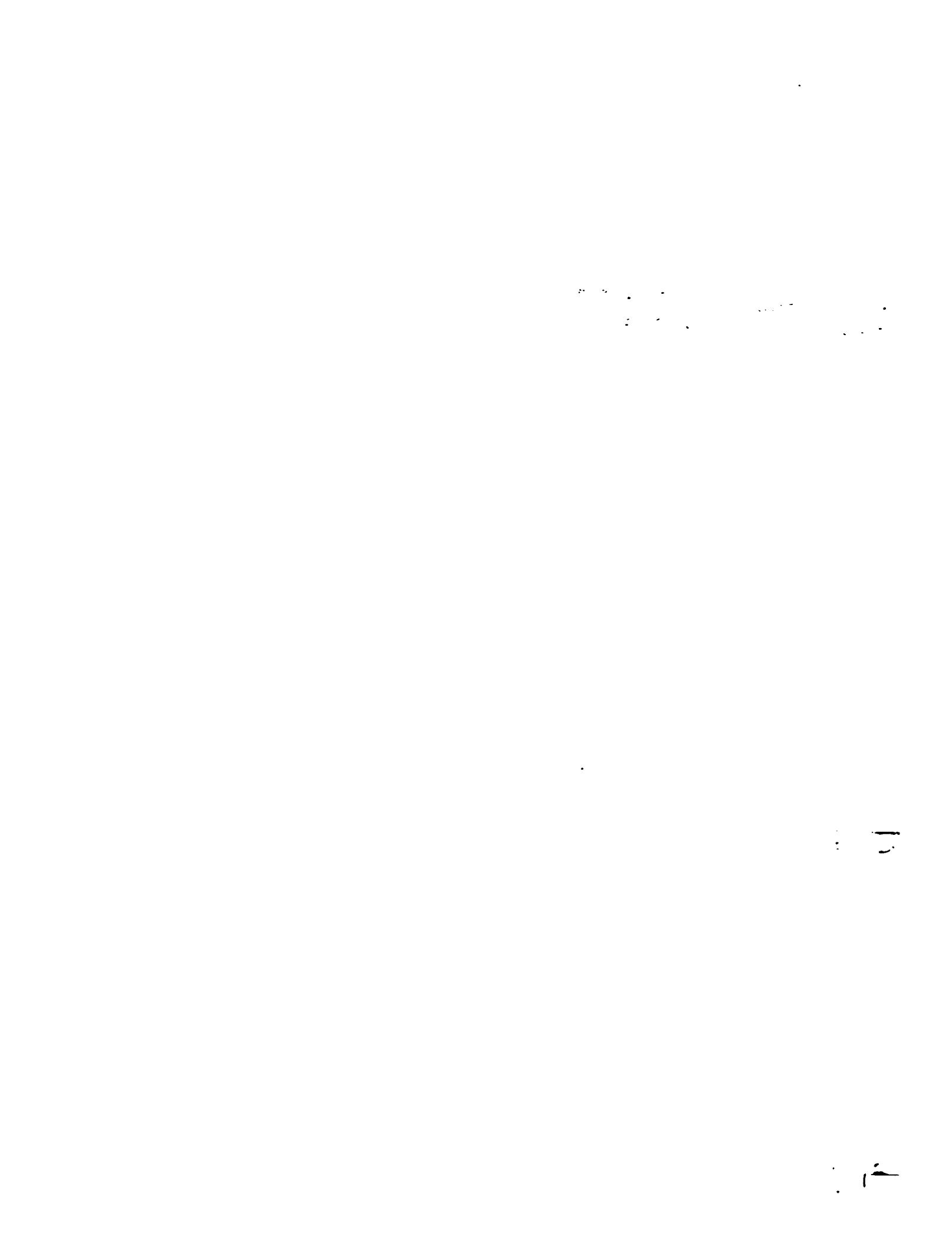
The A-DCS moments of inertia about the centre of mass of the A-DCS units are as follows.

A-DCS /Unit	Moments of Inertia (kg.m ²)						$\pm 5\%$
	I _{uu}	I _{vv}	I _{ww}	I _{uv}	I _{uw}	I _{vw}	
RPU	0.132 TBC _{ADCS}	0.180 TBC _{ADCS}	0 . 2 2 TBC _{ADCS}	3	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}
TXU	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}	TBD _{ADCS}

A-DCS Moments of Inertia

Note : The moments of inertia are defined as follows :

$$\begin{bmatrix} I_{xx} & -I_{xy} & -I_{xz} \\ -I_{yx} & I_{yy} & -I_{yz} \\ -I_{zx} & -I_{zy} & I_{zz} \end{bmatrix} \quad \text{with: } \begin{aligned} I_{xx} &= \int (y^2 + z^2) dm & I_{xy} &= \int xy dm \\ I_{yy} &= \int (x^2 + z^2) dm & \text{and} & I_{xz} = \int xz dm \\ I_{zz} &= \int (x^2 + y^2) dm & I_{yz} &= \int yz dm \end{aligned}$$



2.1. GENERAL

2.1.1. Interface Definition

The interface definition for the instrument is the following :

Instrument	Satellite
Mechanical	
Instrument comprising two (2) internally mounted Attachment bolts electronic units (RPU, TXU)	Washers
Harness between A-DCS units	Ground strap
Thermal	
Thermal finishes for the units	Heaters, thermostats and thermistors for the internally mounted units.

Note : all RF devices from the transmitting and receiving antennas to the A-DCS are under the responsibility of METOP.

2.12. Module / Unit Identification

The Part Number and Identification Code of the A-DCS instrument are :

- | | |
|--|--|
| 1) Equipment Name : | RPU |
| | TXU |
| 2) Purchase Order Or Contract Number : | TBD _{ADCs} |
| 3) Manufacturer Name : | TBD _{ADCs} |
| 4) Part No : | RPU EM : TBD _{ADCs}
RPU FM : TBD _{ADCs} |
| | TXU EM : TBD _{ADCs}
TXU FM : TBD _{ADCs} |
| 5) ID Code : | TBD _{ADCs} |
| 6) METOP ID Code | N/A |

The location of the labels giving these Part Numbers and Identification Codes are defined in the Mechanical Interface Control Drawing (See § 2.1.4.).

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2. MECHANICAL AND THERMAL INTERFACE **DESCRIPTION**

. Instrument Power-Up

'1) TBD_{ADCS}

1.5.4. Instrument Operations During A-DCS Mission Mode

Transmitting Function

The transmitting function is always on, **unless** requested by the **Instrument Supplier** via the operational authority. In this latter case, the operational sequence to switch the **transmitting** function off is **TBD_{ADCS}**.

Specific Mode

The pseudo-message mode is activated by one command **TBD_{ADCS}**.

The pseudo-message mode is desactivated by one command **TBD_{ADCS}**.

1.433. A-DCS Mission Mode

This mode is defined as the normal operating mode of the A-DCS, with the instrument providing nominal receiver / processor functionalities and providing measurement data to the satellite.

The transition from Off Mode to A-DCS shall be done in a step-by-step way as described in § 1.5.3. The temperature constraints (switch-on temperatures) are dealt within § 2.3.2.2.

Switch-on / switch-off of the A-DCS transmitter functions can be done independently during the A-DCS Mission Mode.

1.43. Cross Reference Between Instrument and PLM Modes

Phases	PLM	A-DCS	Comments
Launch and Acquisition Phases	Lift-Off Mode LEOP Mode	Off Mode	
Pre-Operational Phase	Stand-By	Off Mode	
Operational Phase	Operable	Any	
Orbit Control Manoeuvres	Operable	Any	
	Stand-By	Off Mode	
Contingency Cases	Stand-By Fix Safe	Off Mode	

During those modes, the PLM is still operable and the instrument nominal operations are not stopped, even if the generated measurement data may be corrupted. This is not true for the initial orbit corrections, for which the PLM and the instrument status are in LEOP / Off Modes.

1.3.4.2.3. Acquisition Modes

The acquisition modes encompass all actions leading to a stabilized Earth attitude, including deployment of all major appendages.

The corresponding SVM modes are the Rate Reduction Mode (RRM), the Coarse Acquisition Mode (CAM), the Fine Acquisition Modes (FAM1, FAM2 and FAM3) and the Fine Pointing Mode (FPM).

During these modes, the PLM is in the Lift-Off Mode and then LEOP Mode. In general, all instruments are switched off.

1.3.4.2.4. Contingency Cases

In the event of detection of a satellite failure, several back up modes exist at PLM and / or SVM levels.

PLM Failure Cases

For failure at PLM level only, the corresponding PLM modes are the PLM Stand-By Mode, the PLM Fix Mode and the PLM Safe Mode, & pending on the failure. All instruments are switched off.

The SVM is not affected.

SVM Failure Cases

For failure at SVM level, the PLM is forced to PLM Stand-By Mode, PLM Fix Mode or PLM Safe Mode, depending on the failure, and all instruments are switched off.

The SVM enters several modes that lead to a stabilized Earth pointing attitude. From an operational point of view, those modes are similar to the very first attitude acquisition that follows the separation from the launch vehicle, but with deployed appendages.

1.3.4.2.5. Safe Mode (Sun Pointing)

In addition to the previous back-up modes, an ultimate safety level is implemented on METOP. This so-called Safe Mode performs the minimal functions for satellite survival by maintaining a Sun-pointed attitude. During the Safe Mode, the PLM is in the PLM Safe Mode and all instruments are switched off.

1.3.2. Instrument Reference Frame

The following is a requirement for the definition of the instrument reference frame. The frame specific to the A-DCS is defined in § 2.1.3.

The instrument shall have a right handed orthogonal co-ordinate reference system F_{ADCS} (U_{ADCS} , V_{ADCS} , W_{ADCS}) and it shall be defined such that :

- the origin shall be physically located on an accessible, identifiable instrument exterior feature (e.g. the centre of one mounting hole, at the unit baseplate level)
- the U, V instrument axes define the plane that contains the unit mounting feet.
- the W axis is normal to this datum plane.

These axes shall be referred to on all drawings and any finite element description.

133. Orbital Parameters

133.1. Reference Orbit

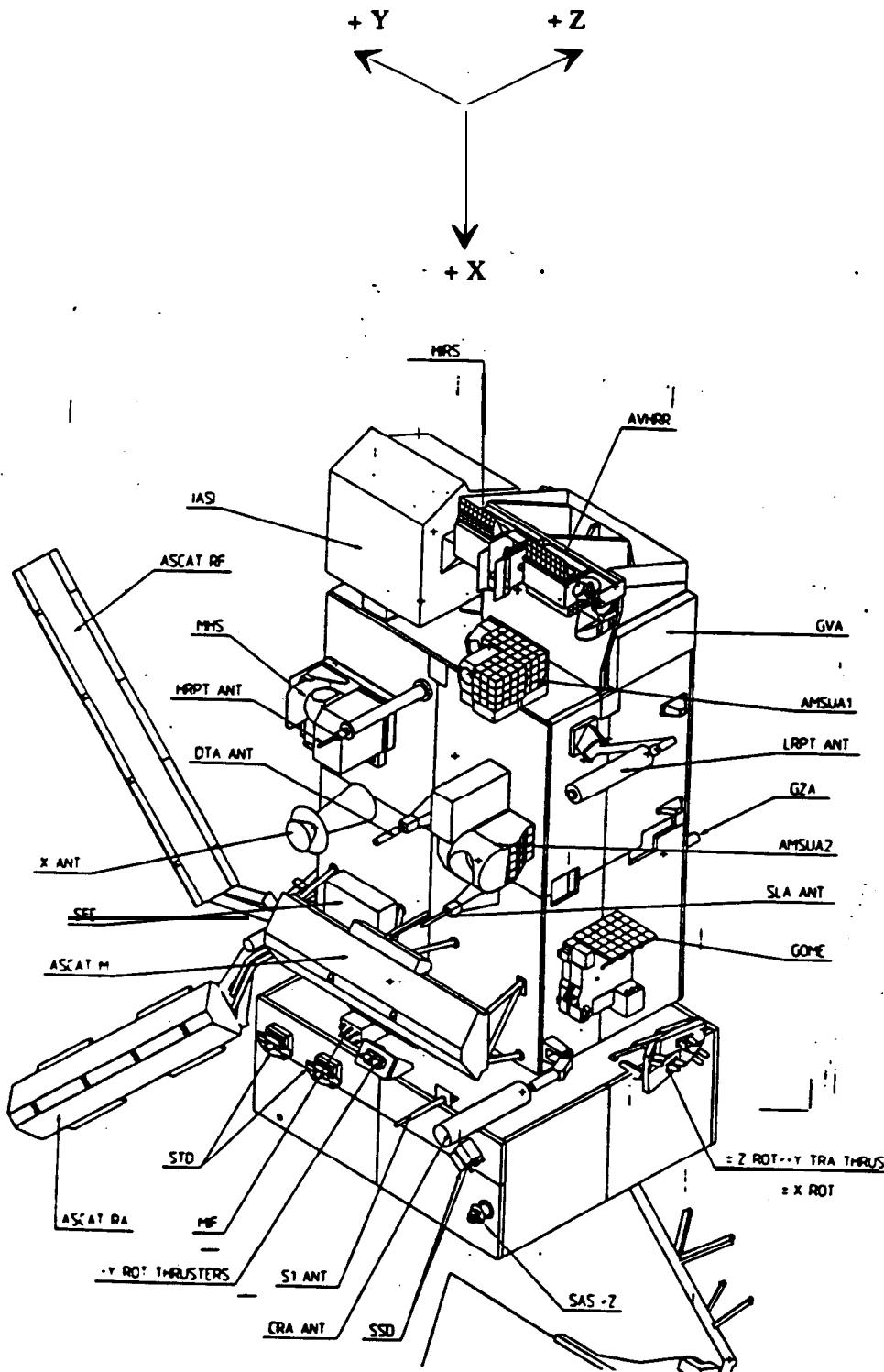
METOP will be placed into the following reference orbit :

- Type:	Sun-synchronous
- Semi-major axis:	7197.939 km
- Repeat Cycle:	5 days (14 + 1/5 orbits per day)
- Local Solar Time:	09:30 A.M. descending node

133.3. Drift Orbit

For METOP-1, the previous orbit will be reached after a 6-month (TBC_{MET}) drifting phase (dual launch). from an initial polar orbit (close to the Sun-synchronous one) with a local solar time around 10:00 AM. descending node.

METOP-2 will be directly launched into the reference orbit.



WARNING : MAY BE SUBJECT TO CHANGE

Figure 1.3.1/1 : METOP Satellite Overall Configuration (For Information Only)

Switching on / off of the A-DCS transmitting function is made through the METOP command and control centre (ground segment).

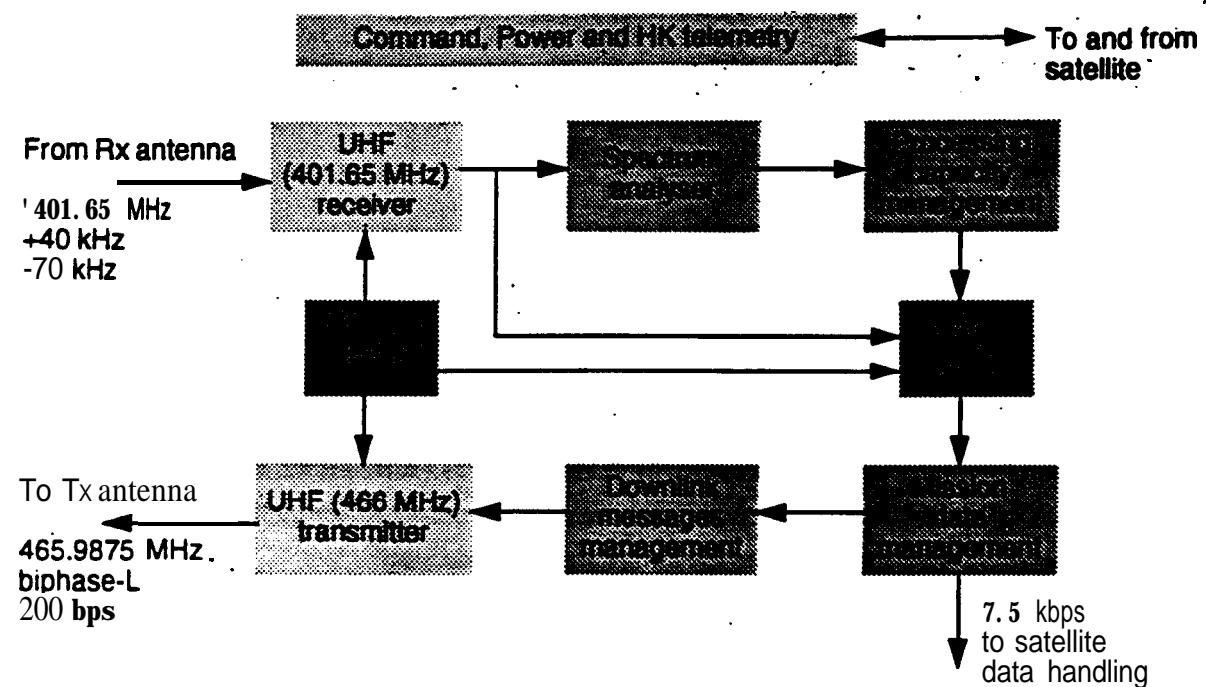


Figure 1.2.3/I : A-DCS Functional Block Diagram

1.2. INSTRUMENT PRESENTATION

13.1. General

(For information only)

<i>Instrument Name</i>	A-DCS Advanced Data Collection System
<i>Classification</i>	Environmental monitoring system

The Advanced Data Collection System A-DCS, known also as ARGOS, collects data from platform transmitters (PTTs) located on continents and oceans in UHF frequency.

Marine PTTs located on buoys transmit oceanographic data, ship PTTs weather and oceanographic data. Land based PTTs provide meteorological and hydrological data and those on balloons atmospheric data.

A-DCS uses Doppler information to enable the location of PTTs. The data are stored on board the satellite for later transmission to ground. A-DCS also includes a transmitter function to send stored messages to the Data Collection Platfams. which have been uplinked via the receiver.

13.2. Scientific Objectives

(For information only)

Over 4000 environmental platforms are located around the Earth to measure environmental factors such as temperature, pressure and currents. Some of these platforms are immersed in a moving fluid, such as the ocean and the atmosphere. These moving platforms, buoys and balloons provide environmental information on velocity and direction of the ocean and wind currents.

1.2.3. Functional Description

The A-DCS block diagram is illustrated in Figure 1.2.3/1. The A-DCS is physically implemented into two units.

The environmental platforms transmit data to the A-DCS at a carrier frequency of 401.650 MHz. digital bi-phase format at 400 bps. The A-DCS demodulates this signal and determines the carrier frequency and relative time of each transmission. This data is processed, formatted, and transferred directly to the ground and to the satellite for real-time or later transmission to ground.

13.3.1. Receiver Power Unit

The receiver linearly converts the incoming signal to an intermediate frequency, that is applied to the input of the search unit and to the Data Recovery Units (DRUs). The search unit is basically a spectrum analyzer which uses a Fast Fourier Transform to cover the 110 kHz operating frequency range.

EMI	Electromagnetic Interference
EOL	End of Life
FAM	Fine Acquisition Mode
FEM	Finite Element Model
FMEA	Failure Modes, Effects and Criticality Analysis
FMU	Formatting and Multiplexing Unit
F O V	Field of View
FPM	Fine Pointing Mode
Gbit	Gigabits
G N S S	Global Navigation Satellite System
GOME-2	Global Ozone Monitoring Experiment
GRAS	GNSS Receiver for Atmospheric Sounding
GSE	Ground Support Equipment
H/W	Hardware
HIRS/4	High Resolution Infra-Red Radiation Sounder
HK	House Keeping
HRPT	High Resolution Picture Transmission
I/F	Interface
IASI	Infra-red Atmospheric Sounding Interferometer
ICD	Interface Control Document
ICU	Instrument Control Unit
IST	Integration System Test
kbps	kilobits Per second
KLM	NOAA K, L, M series of satellites
LEOP	Launch and Early Orbit Phase
LRPT	Low Resolution Picture Transmission
Mbps	Megabits per Second
MCMD	Macro Command
MGSE	Mechanical Ground Support Equipment
MHS	Microwave Humidity Sounder
MIL	Military (standard)
N/A	Not Applicable
NIU	NOM Instrument Interface Unit
OBDH	Onboard Data Handling System
OCM	Orbit Control Mode

1.1. GENERAL

1.1.1. Purpose of the Document

This A-DCS Instrument Interface Control Document defines all interfaces between the A-DCS instrument and the METOP satellite series.

The ICD document forms the sole document for the definition of interfaces and formulates the binding requirements between ESA and the Instrument Supplier. It is configuration controlled by the METOP project team and formally signed off by ESA, the Instrument Supplier and the METOP prime contractor.

The ICD :

- Defines the technical resources allocated to the instrument.
- Defines the detailed mechanical, thermal and electrical interfaces.
- Defines the design verification programme which shall be implemented to demonstrate compliance with the METOP / A-DCS interface requirements.
- Defines the detailed mechanical, electrical and protocol interfaces between the instrument ground support equipment and the METOP PLM ground support equipment.
- Defines the operational interface applicable during ground, launch and flight phases.

The objective of the ICD is to ensure that :

- The instrument is designed 'built and verified within the constraints imposed by the overall payload complement, satellite and launch vehicle,
- The satellite Prime Contractor is able to design, build and verify the satellite in such a manner that all instruments can be successfully integrated into the system,
- The spacecraft system can be successfully launched and operated to achieve the mission objective5 of the METOP programme.

1.13. Documentation

In cases of conflict between the following applicable documents and the latest issue of the ICD, the A-DCS ICD shall govern.

1.13.1. Applicable Documentation

AD1. Product Assurance Requirements for European Third-Party Instruments
Ref. MO-RS-ESA-PA-0080

AD2. Void

AD3. Void

MATRA MARCONI SPACE

A-DCS

Ref. : MO-IC-MMT-DC-0001
Issue : 2 Rev.: 0
Date : June 12th 1998
Page : 1.i

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TBC / TBD LISTS

This document includes several TBD (to be defined) and TBC (to be confirmed) on the following pages.

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1.2 1.13 1.17	-
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TBD_{MET} on Pages	TBC_{MET} on Pages
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-	4.2 4.3 4.8
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6.3	-

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DOCUMENT CHANGE LOG

Issue/ Revision	Date	Modification Nb	Modified pages	Observations
Draft	Nov. 1995	-		New document - PR Issue
Draft2	July 1996		All	Complete revision
Issue 1	Nov. 15th. 1996	-	All	Complete revision
Iss. 1 Rev. A	Jan. 1997	MO-FX-MMT-0078.97	6	-
C/D Proposal	August'1997	MO-NT-MMT-DC-0001	75	-
Issue 2	June 12 th 1998		All	Complete revision

+10 V Interface Bus		
Signal Nomenclature		
Code	DPB	
EMC Class	Power	
Power Source Specification:		
Parameter	Requirement	Remarks
Voltage	9.5...10.5 v	at A-DCS input
Source Current	< 10 mA	
Small Signal impedance	< 1 Ω	f < 10 MHz
Voltage Ripple	See § 4.3.1.2.	
Under-Voltage (incl. ripple & trans.):	> 9.0 v ; < 9.5 v	
Over-Voltage (incl. ripple & trans.):	> 10.5 V ; < 15.0 V	
Voltage Transients:	See § 4.3.1.2.	
Load Specification		
Parameter	Requirement	Remarks
Max. Steady-State Current	1 mA	
Current Ripple	< 1 mA_{pp}	f < 2.5 MHz
Inrush Current	<125% of Max Stdy-State Cur.	for c 60 ms
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24, TP	

3.433. Power Interface Circuits

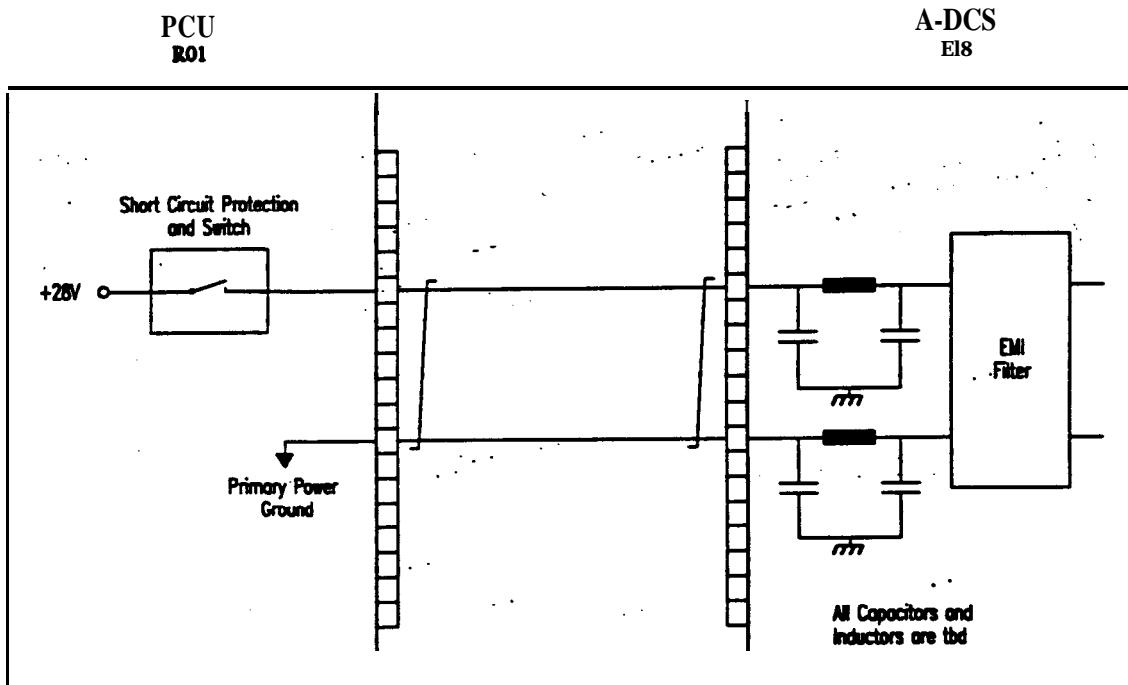


Fig. 3.4.3.2-1 : +28 V Main Power Bus Interface Circuit

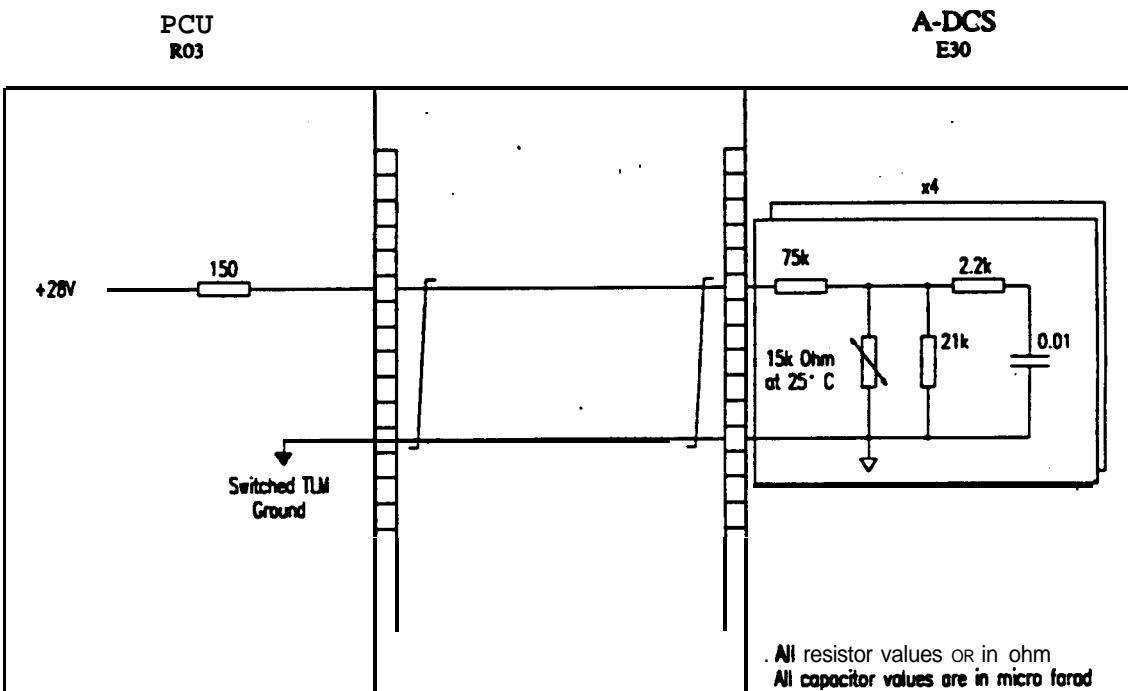


Fig. 3.4.3.2-2 : +28 V Switched TLM Bus Interface Circuit

NIU
R05

A-DCS
E09

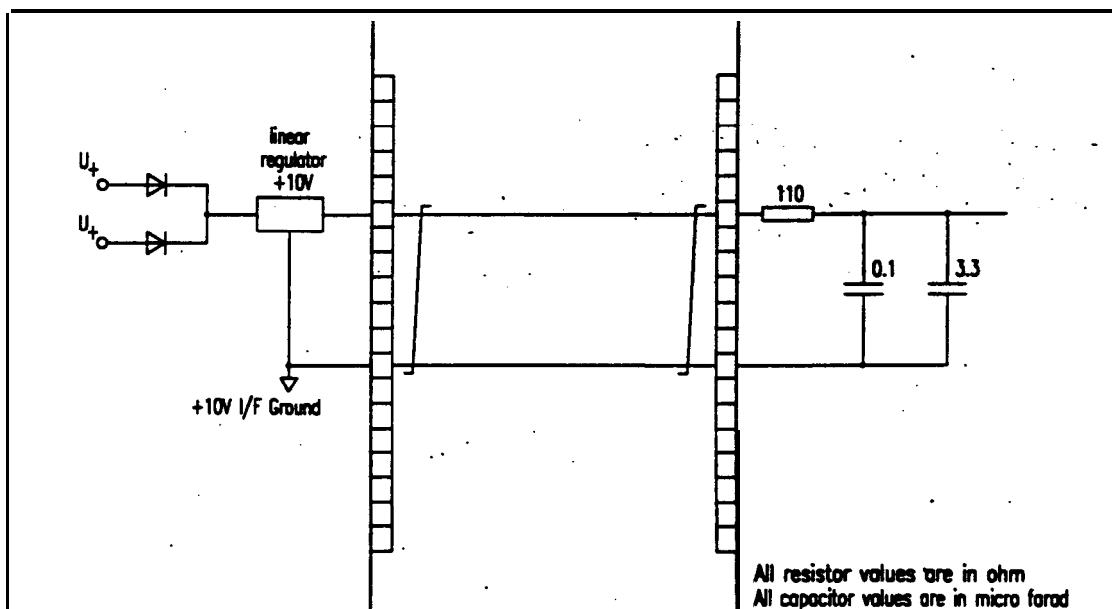


Fig. 3.4.3.2-3 : +10 V Interface Bus Interface Circuit

3.4.4. Power Connectors

Table 3.4.4-1 identifies the power connector types at the A-DCS boxes and Table 3.4.4-2 identifies the power connector types at the A-DCS harness.

Table 3.4.4-1 : **Power Connector Types at A-DCS (RPU) Boxes**

Connector	Connector-Type	Function
J208	DAMA-15P	Power

Table 3.4.4-2 : **Power Connector Types at A-DCS (RPU) Harness**

Connector	Connector-Type	Function
P208	DAMA-15S-NMB	Power

3.4.5. Power Pin Allocation Lists

In these lists, the cross reference between connector pin, signal designation, Interface Data Sheet, target connector and target connector pin is defined and recorded as data base. Per connector one list is prepared.

All pin allocations are working assumptions and TBC_{ADCS}.

Interface Data Sheets can be found in § 3.4.3.1.

The individual pin allocation lists are specified by 10 characters of a alpha numerical connector number. For the A-DCS the first 5 characters are NADCS. Character 6 is reserved. The 7th character is J for a box connector or P for a harness connector. The last three characters define the connector number.

Since these lists also specify wiring and shielding, they will form the basis for harness manufacturing.

The power connector pin allocations at instrument level are described in Table 3.4.5/1. The power connector harness are described in Table 3.4.5/2.

Connector : NADCS-J208	Item : A-DCS	Function : Power	Backshell : N/A
EMC-Category : 1		Conn.-Type : DAMA-15P	

Pin	Signal Designation	Interface-Code			Grouping			Comment	New
		Circ	Signal	Pos.	Ch. ID	Shd	Cable		
01	+28V MainPwr Bus DCS	SUP1	APB-	-	AP00				
09	• 28V MainPwr Bus DCS	.RTN1	APB-	-	AP00				
02	+28V MainPwr Bus DCS	SUP2	APB-	-	AP00				
10	• 28V MainPwr Bw DCS	.RTN2	APB-	-	AP00				
03	• 26V SW TLM Bus DCS	SUP1	BPB-	-	BP00			Pin 3 and Pin 4 are shorted at the P-Conn.	
II	+28V SW TLM Bus DCS	.RTN1	BPB-	-	BP00			Pin 11 and Pin 12 are shorted at the P-Conn.	
04	• 2IV SW TLM Bus DCS	SUP2							
12	• 2IV SW TLM Bus DCS	.RTN2							
07	SC	-							
08	NC	-							
13	NC	-							
14	NC	-							
05	Signal Ground DCS08	.GND	GND-	-	GD20				
06	Signal Ground DCS08	.GND	GND-	-	GD20				
15	Chassis Ground DCS08	-							

Table 3.4.5/1 : Pin Allocation List of Connector J208 (TBC_{ADCS})

Connector : NAIDCS-P208 Item : A-DCS Function : Power Conn.-Type : DAMA-15S-NMB
 EMC-Category : I Location : 2 F Backshell : TBD

Pin	Signal	Designation	Interface-Code		Grouping				Comment	End-It.	Loc.	Connector	Pin	New	
			Circ	Signal	Pa.	Ch.	I D	Wiring	Shd	Cable	Twist				
01	+28V MainPwr Bus DCS	.SUP1	APB-	-		1P00		T4-20					CU	2C	PPCU Pxx
09	+28V MainPwr Bus DCS	.RTN1	APB-	-		1P00		T4-20					CU	2C	PPCU Pxx
02	+28V MainPwr Bus DCS	.SUP2	APB-	-		1P00		T4-20					CU	2C	PPCU Pxx
10	+28V MainPwr Bus DCS	.RTN2	APB-	-		1P00		T4-20					CU	2C	PPCU Pxx
03	+28V SW TLM Bus DCS	.SUP1	BPB-	-		3P00		TP-24					CU	2C	PPCU Pxx
11	+28V SW TLM Bus DCS	.RTN1	BPB-	-		3P00		G-24					CU	2C	PPCU Pxx
04	+28V SW TLM Bus DCS	.SUP2													
12	+28V SW TLM Bus DCS	.RTN2													
07	NC														
08	NC														
13	NC														
14	NC														
05	Signal Ground DCS08	.GND	GND-	-		GD20		SL-20					PCU	2C	PPCU Pxx
06	Signal Ground DCS08	.GND	GND-	-		GD20		SL-20					PCU	2c	PPCU Pxx
15	Chassis Ground DCS08														

Table 3.4.5/2 : Pin Allocation List of Connector P208

(For Information Only)

3.5. SIGNAL ELECTRICAL INTERFACES

3.5.1. Overview

An overview on the A-DCS signal is presented in Fig. 3.5-1.

Signal interfaces with the PLM units are specified in § 3.5.2.

Signal interfaces with the RFF and the DTA and A-DCS internal interfaces are specified in § 3.5.3.

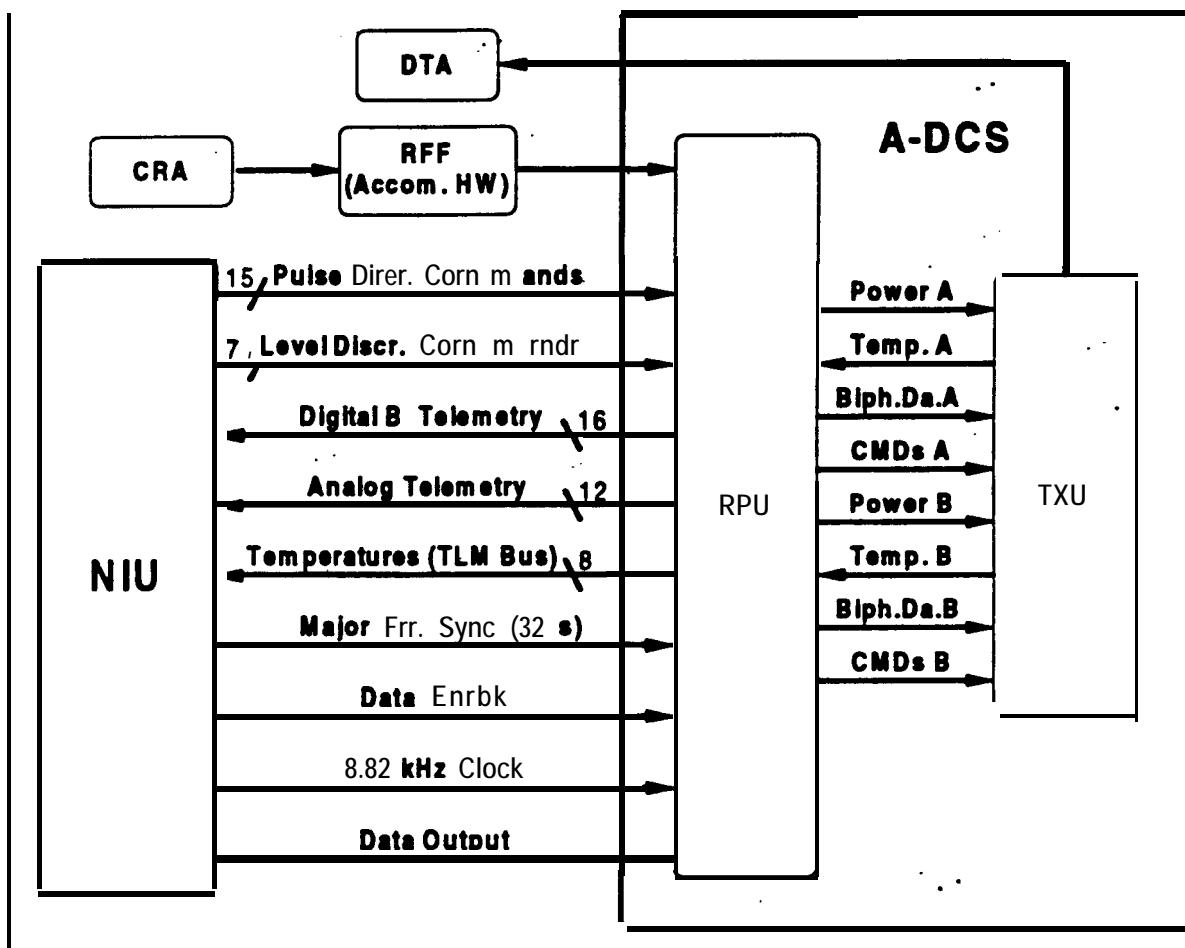


Fig. 3.5-1 : A-DCS Signal Interface

353. Signal **Interfaces** With PLM Units

3.5.2.1. Signal **Interface Requirements** (Interfaces With **PLM** Units).

Table 3.5.2.1-1 lists all **signals** of the A-DCS signal **electrical interface** with the **PLM** and gives references to the **Interface Data Sheets** in § 3.5.2.1.1 and the **interface circuits** in § 3.5.2.1.2.

Table 3.5.2.1-I : *Signal@ Da@ Sheets & Interface Circuits Assignments (1/2)*

Signal	Data Sheet Code	Interface Circuit	Remarks
Pulse CMD 1 -DCS Pulse CMD 2 -DCS Pulse CMD 3 -DCS Pulse CMD 4 -DCS Pulse CMD 5 -DCS Pulse CMD 6 -DCS Pulse CMD 7 -DCS Pulse CMD 8 -DCS Pulse CMD 9 -DCS Pulse CMD 10 -DCS Pulse CMD 11 -DCS pulse CMD 12 -DCS Pulse CMD 13 -DCS Pulse CMD 14 -DCS Pulse CMD 15 -DCS	CCP	Fig. 3.5.21.2-1	Pulse Discrete Commands
Level CMD 1 DCS Level CMD 2 DCS Level CMD 3 DCS Level CMD 4 DCS Level CMD 5 DCS Level CMD 6 DCS Level CMD 7 DCS	CCL	Fig. 35.2.1.2-1	Level Discrete Commands
Digital B TLM 1 DCS Digital B TLM 2 -DCS Digital B TLM 3 -DCS Digital B TLM 4 -DCS Digital B TLM 5 -DCS Digital B TLM 6 -DCS Digital B TLM 7 -DCS Digital B TLM 8 -DCS Digital B TLM 9 -DCS Digital B TLM 10 -DCS Digital B TLM 11 -DCS Digital B TLM 12 -DCS Digital B TLM 13 -DCS Digital B TLM 14 -DCS Digital B TLM 15 -DCS Digital B TLM 16 -DCS	TLD	Fig. 3.5.2.1.2-2 Rg. 3.5.2.1.2-3 TBD_{ADCs}	Digital B HK Telemetry

Table 3.5.2.1-1 : Signal to Data Sheets & Interface Circuits Assignments (2/2)

Signal	Data Sheet Code	Interface Circuit	Remarks
Analog TLM 1 DCS Analog TLM 2 DCS Analog TLM 1 DCS Analog TLM 4 DCS Analog TLM 5 DCS Analog TLM 6 DCS Analog TLM 7 DCS Analog TLM 8 DCS Analog TLM 9 DCS Analog TLM 10 DCS Analog TLM 11 DCS Analog TLM 12 DCS	TLA	Fig. 3.5.2.1.2-4 I -5 / -6 / -7 / -8 or -9 TBD _{ADCs}	Analog HK Telemetry
Analog Temperature TLM 1 -DCS Analog Temperature TLM 2 -DCS Analog Temperature TLM 3 -DCS Analog Temperature TLM 4-DCS Analog Temperature TLM 5-DCS Analog Temperature TLM 6-DCS Analog Temperature TLM 7-DCS Analog Temperature TLM 8-DCS			
Major Frame Sync (32 s) A-DCS Data Enable A-DCS Data Output A-DCS 8.32 kHz Clock A-DCS	SYT DEN WA CLU	Fig. 35.21.2-11 Rg. 3.5.2.1.2-12 Fig. 3.5.2.1.2-13	Temperatures (Switched TLM Bus) Timing see § 3.3' Measurement Data

3.5.2.1.1. Signal Interface Data Sheets (**Interfaces With PLM Units**)

On the following pages, the electrical characteristics of signal electrical interfaces are defined with one Data Sheet per signal. In § 3.5.2.1 ‘Signal Interface Requirements’ and § 3.5.2.3 ‘Signal Pin Allocation Lists’ is referenced to these Data Sheets.

The performances specified in the Data Sheets are maintained during the mission lifetime and under nominal load and temperature range conditions. Source specifications have to be measured at the connector of the source and load specifications have to be measured at the connector of the load unless specified otherwise.

The Fault Voltage Protection is the maximum externally induced voltage that the specified input or output can withstand without damage. The Fault Voltage Emissions is the maximum internally generated voltage that the specified input or output can create under worst case fault conditions.

Signal Nomenclature	Pulse Discrete Commands (Short)	
Code	CCP	
EMC Class	Signal	
Source Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level / TRUE'	-0.2 ... +0.2 V	line to 10 V I/F ground
'0' - Level / FALSE' (V_{OH})	+9.3 ... +10.7 V	line to 10 V I/F ground
Rise Time 10% to 90%	< 12 µs	cable length < 5 m
Fall Time 90% to 10%	< 12 µs	cable length < 5 m
Pulse Duration	55 ... 65 ms	'1' - Level
Output Impedance	< 1.5 kΩ	R (CMOS output) + 200 Ω
source current	> 1 mA	@ $V_{OH} = 9.5$ V
Fault Voltage Emissions	0 V ... V_{DD}	$R_S > 100$ Ω
Fault Voltage Protection	-0.5 V ... $V_{DD} + 0.5$ V	V_{DD} see Note
Load Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.5 ... +2 V	line to 10 V I/F ground
'0' - Level	+8.0 ... +10.8 V	line to 10 V I/F ground
Sink Current	< 1 mA	
Input Impedance	> 90 kΩ	
Fault Voltage Emissions	0 V ... V_{DD}	$R_S > 2$ kΩ
Fault Voltage Protection	-0.5 V ... $V_{DD} + 0.5$ V	V_{DD} see Note
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24, single line	return via +10 V I/F ground
<p>Note: V_{DD} is the common supply voltage for the source and the load circuit. Definition of V_{DD}: see Data Sheet '+ 10 V Interface Bus - DPB' in § 3.4.3.1.</p>		

Signal Nomenclature		Level Discrete Commands	
Code		CCL	
EMC Class		Signal	
Source Circuit Specification			
Parameter	Requirement	Remarks	
'1' - Level (= True = 0 VDC)	-0.2 ... +0.2 V	line to 10 V I/F ground	
'0'-Level (= False = 10 VDC ; V _{OH})	+9.3 ... +10.7 V	line to 10 V I/F ground	
Rise Time 10% to 90%	< 12 µs	cable length < 5 m	
Fall Time 90% to 10%	< 12 µs	cable length < 5 m	
Output Impedance	< 1.5 kΩ	R (CMOS output) + 200 Ω	
Source Current	> 1 mA	@ V _{OH} = 9.5 V	
Fault Voltage Emissions	0 V ... V _{DD}	R _S > 100 Ω	
Fault Voltage Protection	-0.5 V ... V _{DD} + 0.5 V	V _{DD} defined in Data Sheet CCP	
Load Circuit Specification			
Parameter	Requirement	Remarks	
'1' - Level	-0.5 ... +2 V	line to 10 V I/F ground	
'0' - Level	+8.0 ... +10.8 V	line to 10 V I/F ground	
Sink Current	< 1 mA		
Input Impedance	> 90 kΩ		
Fault Voltage Emissions	0 V ... V _{DD}	R _S > 2 kΩ	
Fault Voltage Protection	-0.5 V ... V _{DD} + 0.5 V	V _{DD} defined in Data Sheet CCP	
Harness Design			
Parameter	Requirement	Remarks	
wiring Type	AWG 24, single line	return via +10 V I/F ground	

Digital B Telemetry		
Signal Nomenclature		
Code	TLD	
EMC Class	Signal	
Source Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.1 ... +0.5 v	Ground reference
'0' - Level	+3.5 ... +5.7 v	See interface circuit
Spectral Frequency Range	0 ... 200 Hz	for f > 200 Hz filter required ; sampling rate see under Load
Output Impedance	2 kΩ .. 15 kΩ	
source Current	> 60 μA	
Fault Voltage Emissions	-15 ... +15 v	R _s > 0.2 kΩ
Fault Voltage Protection	-15 ... +15 v	R _s > 0.2 kΩ
Load Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.2 ... +0.8 V	line to 10 V I/F ground
'0' - Level	+3.0 ... +5.7 v	line to 10 V I/F ground
Sink Current	< 60 μA	
Sampling Rate!	0.125 ... 16 s	
Fault Voltage Emissions	-15 ... +15 V	R _s > 0.2 kΩ
Fault Voltage Protection	-15 ... +15 v	
Input Impedance	>100 kΩ	
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24, single line	return via 10 V I/F ground

Analog HK Telemetry		
Signal Nomenclature		
Code	TLA	
EMC Class	Signal	
Source Circuit Specification		
Parameter	Requirement	Remarks
Voltage Range'	0 ... 5.12 v	load > 2 MΩ
Spectral Frequency Range	0 ... 200 Hz	for f > 200 Hz filter required ; sampling rate see under Load
Output Impedance	2 kΩ ... 15 kΩ	
source current	> 3 μA	
Fault Voltage Protection	-15 ... +15 v	R _s > 2 kΩ
Fault Voltage Emissions	-15 ... +15 v	R _s > 2 kΩ
Load Circuit Specification		
Parameter	Requirement	Remarks
Input Voltage Range	0 ... 5.12 v	Line to return
Sampling Rate	0.125 ... 16 s	
Conversion Resolution	8 bit	20 mV/LSB
Measurement Accuracy	20 mV	
Sink Current	< 3 μA	
Fault Voltage Protection	-15 ... +15 v	
Fault Voltage Emissions	-15 ... +15 v	R _s > 2 kΩ
Input Impedance	> 2 MΩ	
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24, Single Line	Return via Signal Ground or Sw. TLM Ground (See J/F Circuits)

Signal Nomenclature		Sync 32 s
Code		SYT
EMC Class		Signal
Source! circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.2 ... +0.2 v	line to 10 V I/F ground
'0' - Level (V_{OH})	+9.3 ... +10.7 v	line to 10 V ground
Repetition Rate	32s	tolerances : see Table 3.3.2-1
Stability	tolerances : see Table 3.3.2-1	
Pulse Width	$240.4 \mu s \pm 1.7 \mu s$	at '1' - Level
Rise Time 10% to 90%	< 2 μs	cable length < 5 m
Fall Time 90% to 10%	< 2 μs	cable length < 5 m
output Impedance	< 1.5 k Ω	R (CMOS output) + 200 Ω
source Current	> 1 mA	@ $V_{OH} = 9.5$ v
Fault Voltage Emissions	0 V ... V_{DD}	$R_s > 100 \Omega$
Fault Voltage Protection	-0.5 v ... $V_{DD} + 0.5$ v	V_{DD} defined in Data Sheet CCP
Load Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.5.... +2 v	line to 10 V I/F ground
'0' - Level	+8.0 ... +10.8 V	line to 10 V I/F ground
Sink Current	< 1 mA	
Input Impedance	> 90 k Ω	
Fault Voltage Emissions	0 V ... V_{DD}	$R_s > 2 k\Omega$
Fault Voltage Protection	-0.5 V ... $V_{DD} + 0.5$ V	V_{DD} defined in Data Sheet CCP
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24, single line	return via +10 V I/F ground

Signal Nomenclature		Data Enable
Code	DEN	
EMC Class	Signal	
Source Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.2 ... +0.2 V	line to 10 V I/F ground
'0' - Level (V_{OH})	+9.3 ... +10.7 V	line to 10 V I/F ground
Number of Samples	93 per 100 ms	
Stability	derived from 8.32 kHz Clock	see Data Sheet CLU
Pulse Width	(39/5) x (1/8.32 kHz Clock)	at '1' - Level
Rise time 10% to 90%	< 2 µs	cable length < 5 m
Fall Time 90% to 10%	< 2 µs	cable length < 5 m
Output Impedance	< 1.5 kΩ	R (CMOS output) + 200 Ω
Source Current	> 1 mA	@ $V_{OH} = 9.5$ V
Fault Voltage Emissions	0 V ... V_{DD}	$R_S > 100 \Omega$
Fault Voltage Protection	-0.5 V ... $V_{DD} + 0.5$ V	V_{DD} defined in Data Sheet CCP
Load Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.5 ... +2 V	line to 10 V I/F ground
'0' - Level	+8.0 ... +10.8 V	line to 10 V I/F ground
Sink Current	< 1 mA	I
Input Impedance	> 90 kΩ	I
Fault Voltage Emissions	0 V ... V_{DD}	$R_S > 2 \text{ k}\Omega$
Fault Voltage Protection	-0.5 V ... $V_{DD} + 0.5$ V	V_{DD} defined in Data Sheet CCP
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24. single line	return via 10 V I/F ground

Signal Nomenclature		Data Output
Code		DOA
EMC Class		Signal
Source Circuit Specification:		
Parameter	Requirement	Remarks
'1' - Level:	-0.2 ... +0.2 v	line to 10 V I/F ground
'0' - Level (V_{OH})	+9.3 ... +10.7 v	line to 10 V I/F ground
Data Word Rate (Burst)	93 x 8-bit words per 100 ms	
Rise Time 10% to 90%	< 2 μ s	cable length < 5 m
Fall Time 90% to 10%	< 2 μ s	cable length < 5 m
Output Impedance	< 1.5 k Ω	R (CMOS output) + 200 Ω
Source Current	> 1 mA	@ $V_{OH} = 9.5$ V
Fault Voltage Emissions	0 V ... V_{DD}	$R_S > 100 \Omega$
Fault Voltage Protection	-0.5 v ... V_{DD} + 0.5 v	V_{DD} defined in Data Sheet CCP
Load Circuit Spedification		
Parameter	Requirement	Remarks
'1' - Level	-0.5 ... +2 V	line to 10 V I/F ground
'0' - L e v e l	t8.0 ... +10.8 V	line to 10 V I/F ground
Sink Current	< 1 mA	
Input impedance	> 90 k Ω	
Fault Voltage Emissions	0 V ... V_{DD}	$R_S > 2 k\Omega$
Fault Voltage Protection	-0.5 V ... V_{DD} + 0.5 V	V_{DD} defined in Data Sheet CCP
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24, single line	return via 10 V I/F ground

Signal Nomenclature		
8.32 kHz Clock		
Code	CLU	
EMC Class	Signal	
Source Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.2 ... +0.2 v	line to 10 V I/F ground
'0' - Level (V_{OH})	+9.3 ... +10.7 v	line to 10 V I/F ground
Repetition Rate	8.32 kpps \pm 0.01 %	
Stability	$< 5 \cdot 10^{-9}$ / sec	
Frequency Drift per Week	$< 5 \cdot 10^{-6}$	over temperature range
Frequency Drift per Year	$< 1 \cdot 10^{-6}$	at constant temperature
Pulse Width	$24 \mu s \pm 1.7 \mu s$	at '1' - Level
Rise Time 10% to 90%	$< 2 \mu s$	cable length < 5 m
Fall Time 90% to 10%	$< 2 \mu s$	cable length < 5 m
Output Impedance	$< 1.5 \text{ k}\Omega$	R (CMOS output) + 200 Ω
Source current	$> 1 \text{ mA}$	@ $V_{OH} = 9.5 \text{ v}$
Fault Voltage Emissions	0 v ... V_{DD}	$R_s > 100 \Omega$
Fault Voltage Protection	-0.5 v ... $V_{DD} + 0.5 \text{ v}$	V_{DD} defined in Data Sheet CCP
Load Circuit Specification		
Parameter	Requirement	Remarks
'1' - Level	-0.5 ... +2 v	line to 10 V I/F ground
'0' - Level	+8.0 ... +10.8 V	line to 10 V I/F ground
Sink Current	$< 1 \text{ mA}$	
Input Impedance	$> 15 \text{ k}\Omega$	
Fault Voltage Emissions	0 v ... V_{DD}	$R_s > 2 \text{ k}\Omega$
Fault Voltage Protection	-0.5 v ... $V_{DD} + 0.5 \text{ v}$	V_{DD} defined in Data Sheet CCP
Harness Design		
Parameter	Requirement	Remarks
Wiring Type	AWG 24. single line	line to 10 V I/F ground

3.5.2.1.2. Signal Interface Circuits (Interfaces With PLM Units)

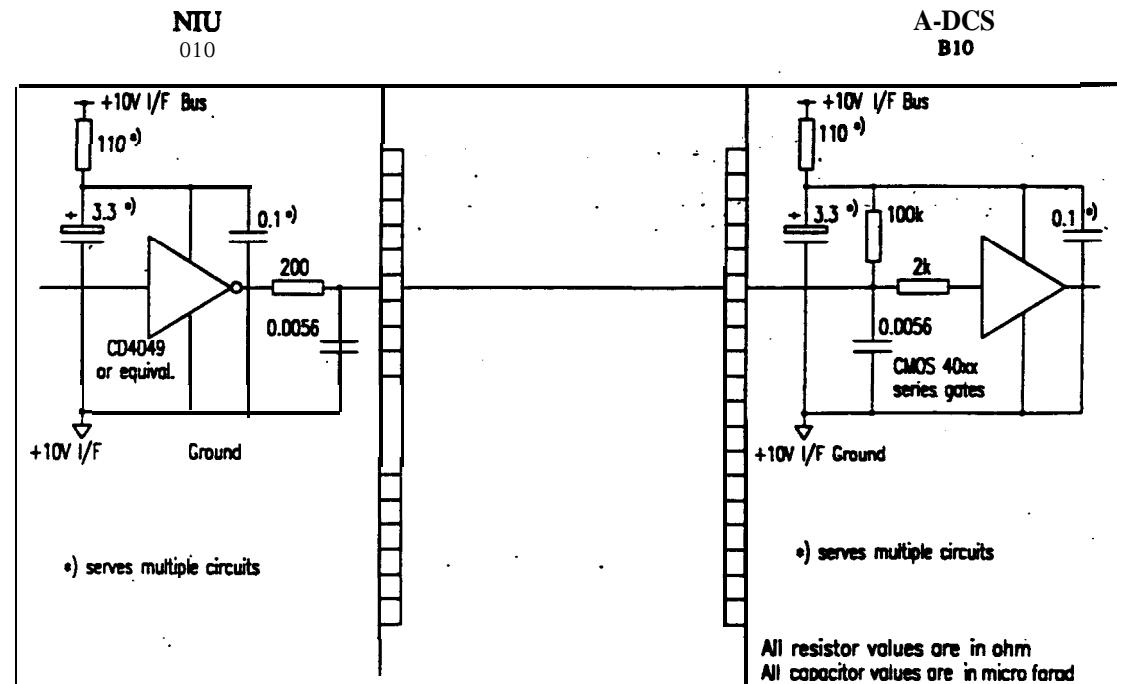


Fig. 3.5.2.1.2-1 : A-DCS Pulse and Level Discrete Command Interface Circuit

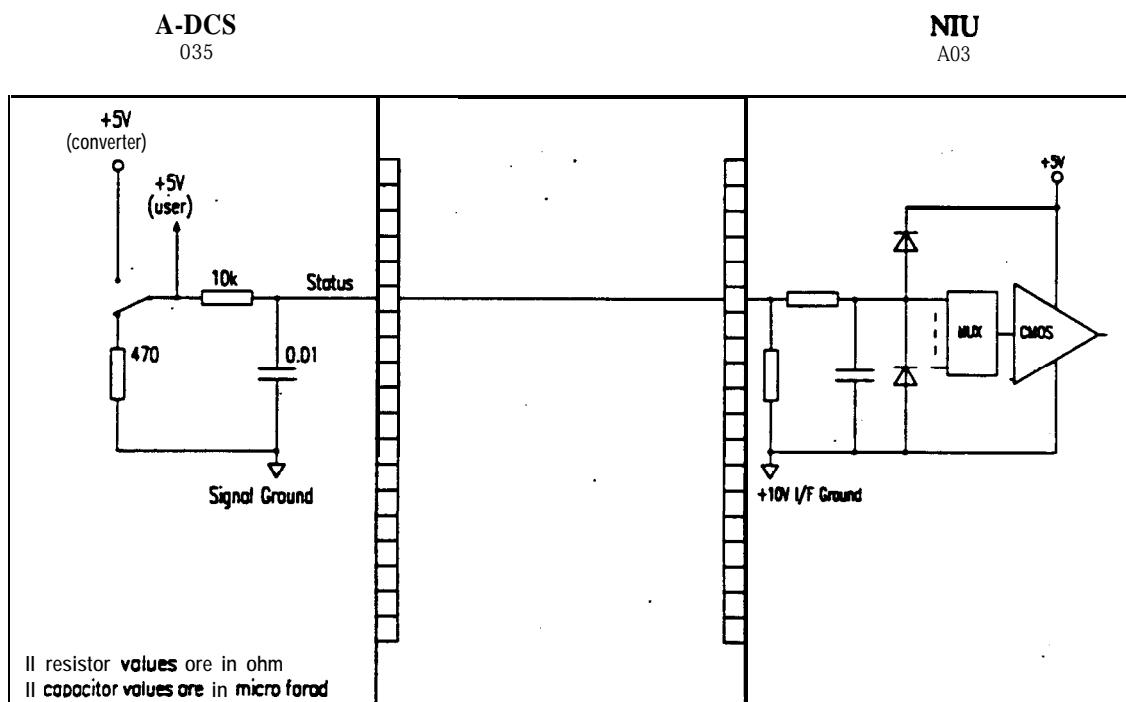


Fig. 3.5.2.1.2-2 : A-DCS Digital B Telemetry Relay Status Interface Circuit

A-DCS
036

NIU
A03

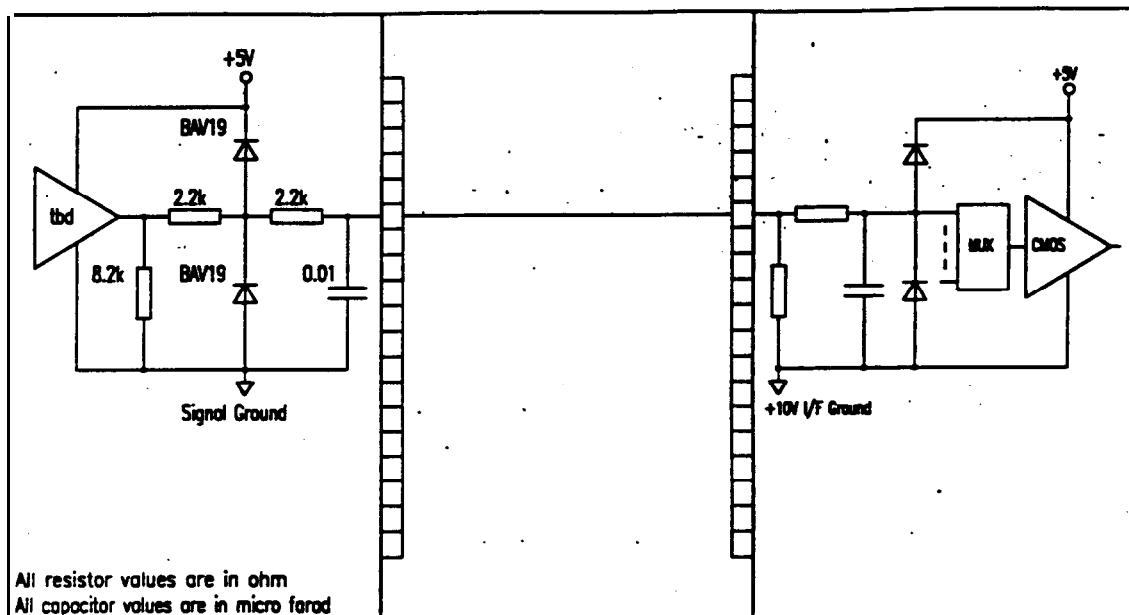
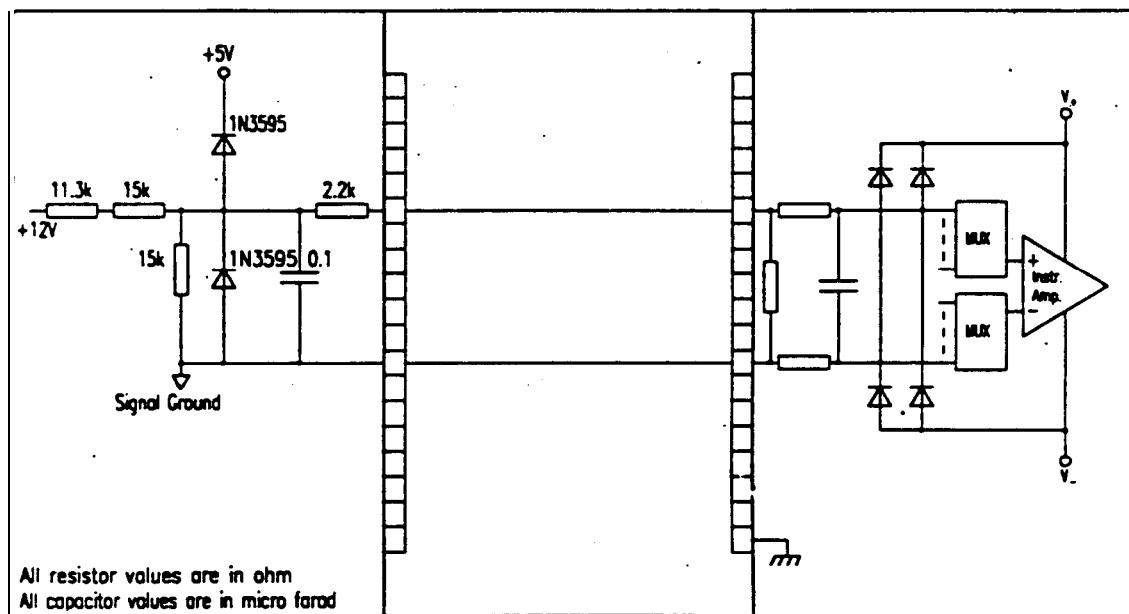


Fig. 3.5.2.1.2-3 : A-DCS Digital B Tekmeby Status Interface Circuit

A-DCS
037

NIU
A 13

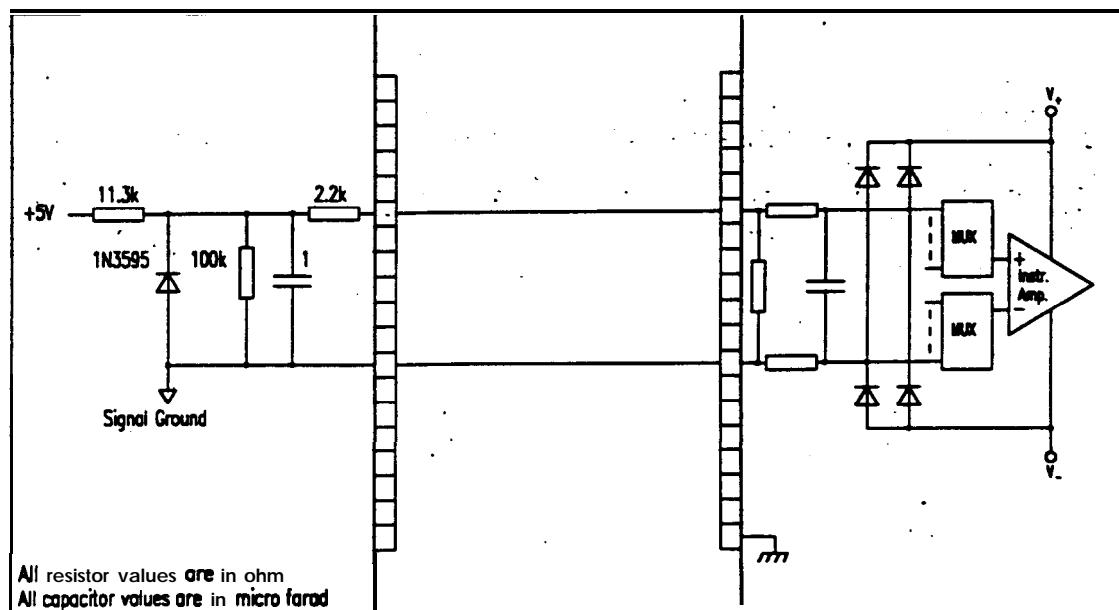


Only one Signal Ground line is provided from A-DCS for all analog TLM interfaces

Fig. 3.5.2.1.2-4 : A-DCS +12 V Analog Telemetry Interface Circuit

A-DCS
038

NIU
A13

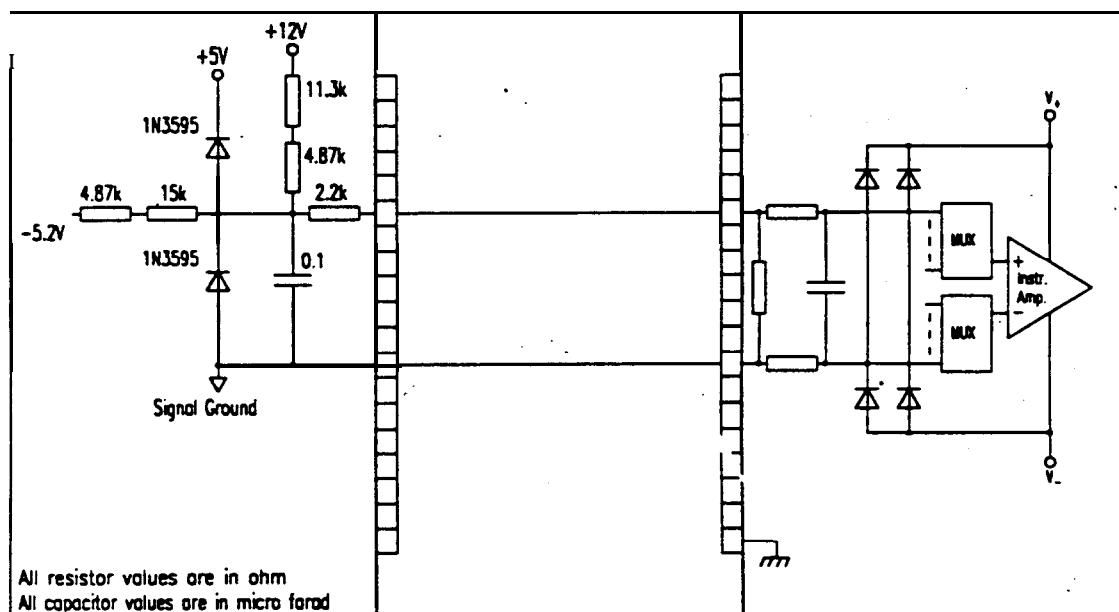


Only one Signal Ground line is provided from A-DCS for all analog TLM interfaces

Fig. 3.5.2.1.2-5 : A-DCS +5.2 V Analog Telemetry Interface Circuit

A - D C S
039

NIU
A 1 3

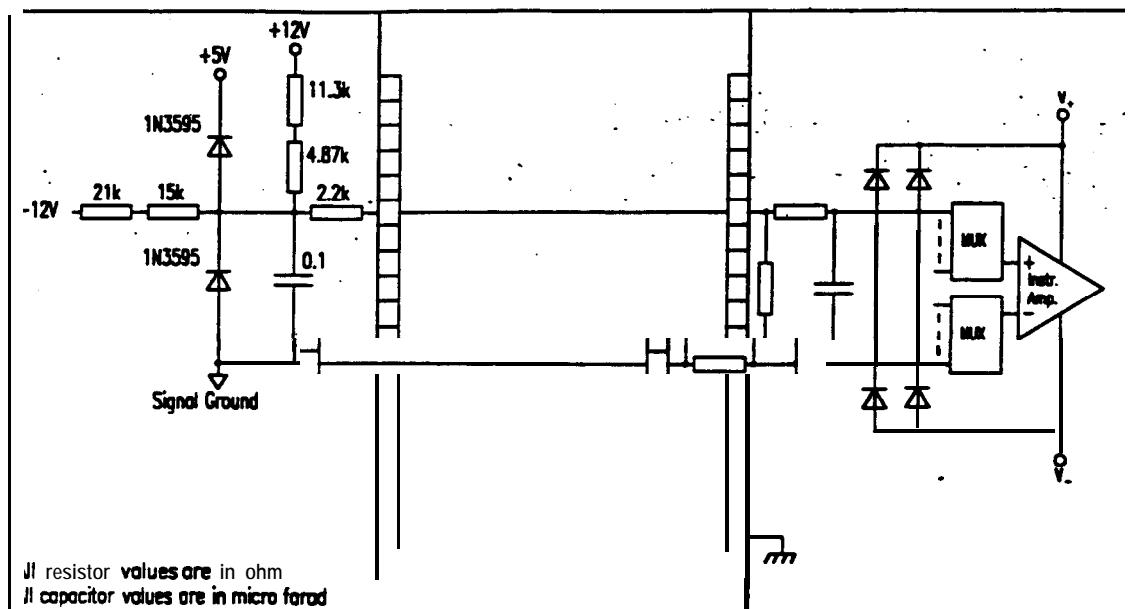


Only one Signal Ground line is provided from A-DCS for all analog TLM interfaces

Fig. 3.5.2.1.2-6 : A-DCS -5.2 V An&g Telemetry Interface Circuit

A-DCS
040

NIU
A13

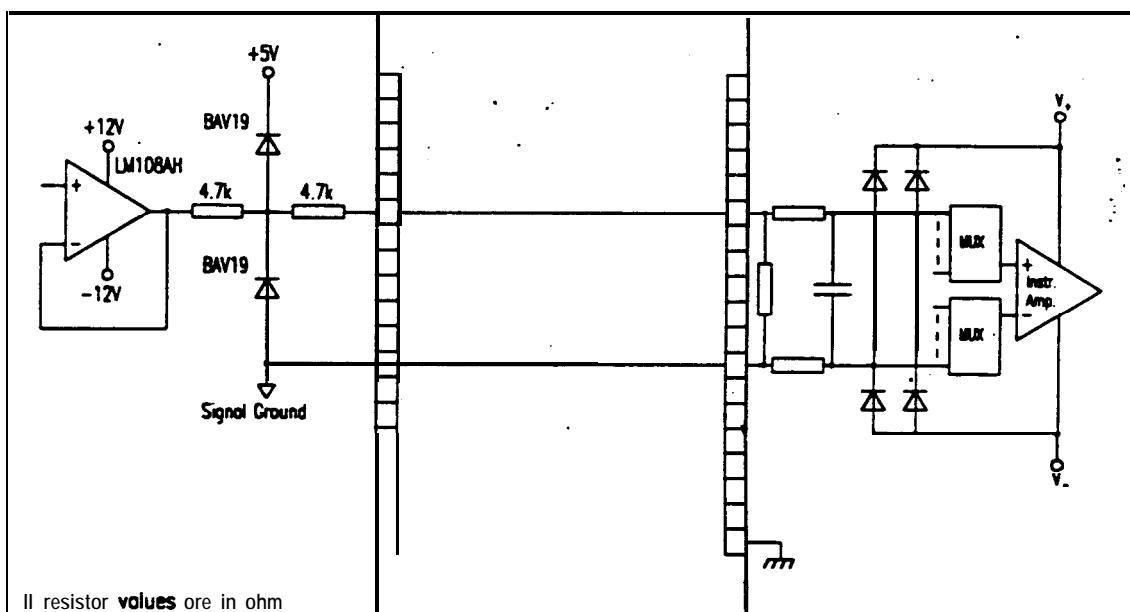


Only one Signal Ground line is provided from A-DCS for all analog TLM interfaces

Fig. 3.5.2.X.2-7 : A-DCS -12 V Analog Telemetry Interface Circuit

A-DCS
043

NIU
A 1 3

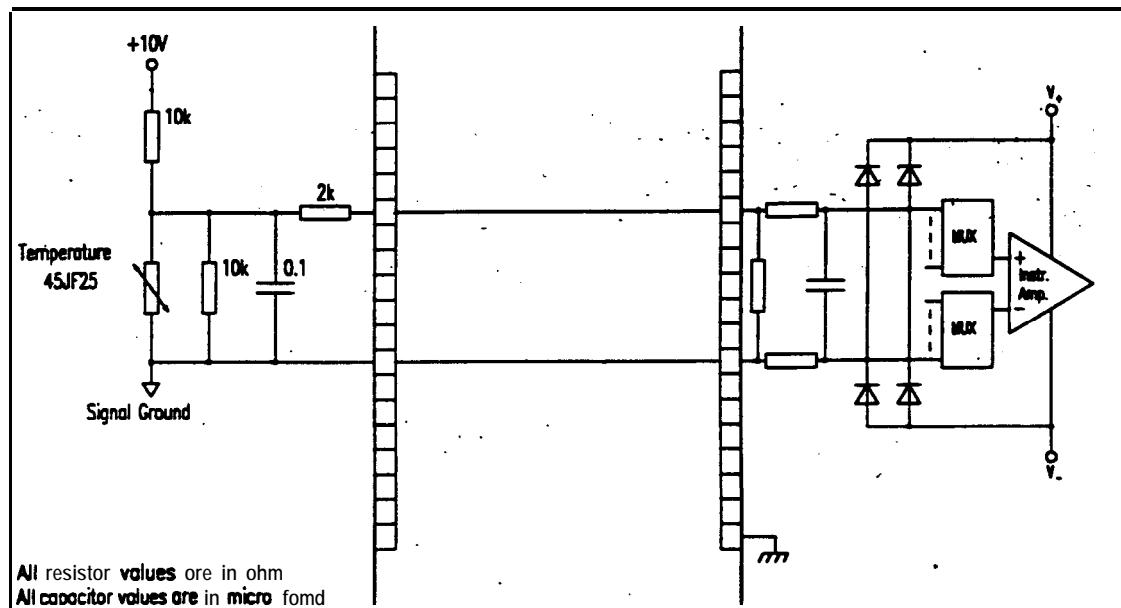


Only one Signal Ground line is provided from A-DCS for all analog TLM interfaces

Fig. 3.5.2.1.2-8 : A-DCS USO Thermal Regulation Voltage Telemetry Interface Circuit

A-DCS
042

NIU
A13

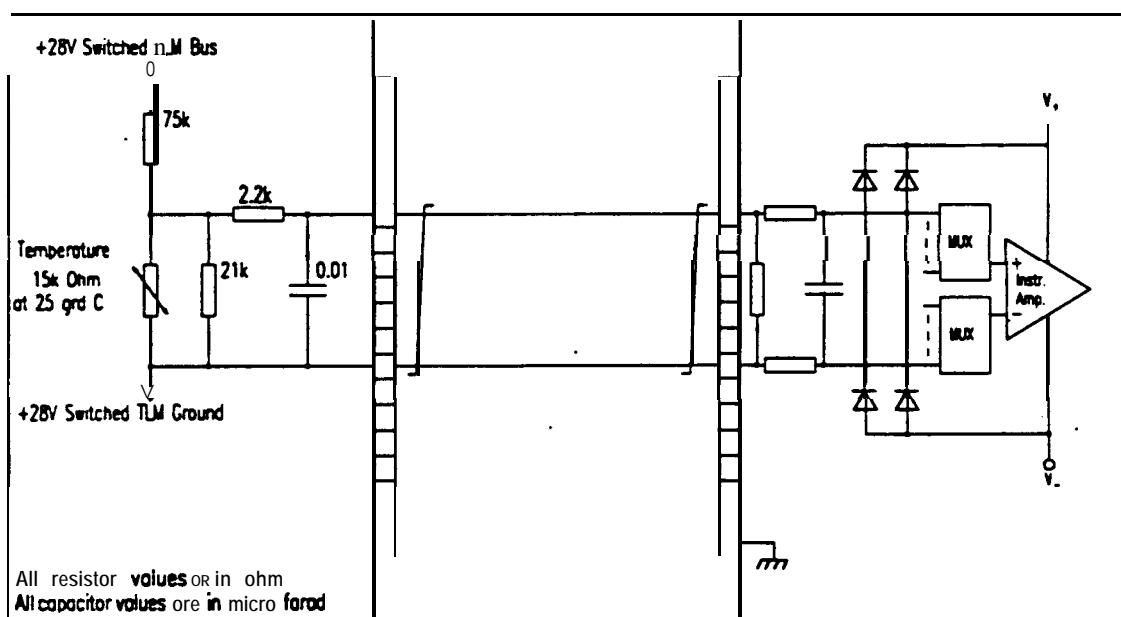


Only one Signal Ground line is provided from A-DCS for all analog TLM interfaces

Fig. 3.5.2.1.2-P : A-DCS **USO Temperature Telemetry Interface** Circuit

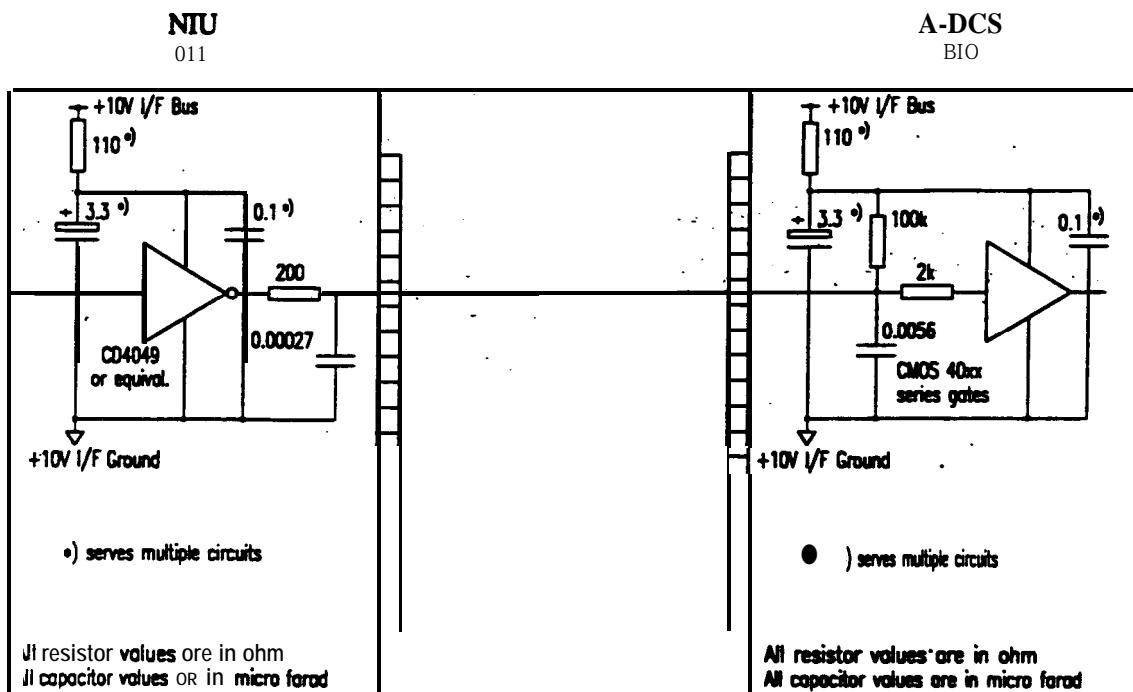
A-DCS
041

NIU
A13



Only one Switched TLM Ground line is provided from A-DCS for all temperature (Sw. TLM bus) interfaces

Fig. 3.5.2.1.2-10 : A-DCS **Temperature Telemetry (Switched TLM Bus) Interface** Circuit

Fig. 3.5.2.1.2-11 : A-DCS **Frame Sync Interface Circuit**

A-DCS (Digital Data A)
 NIU (Data Enable)
 011

NIU (Digital Data A)
 A-DCS (Data Enable)
 B11

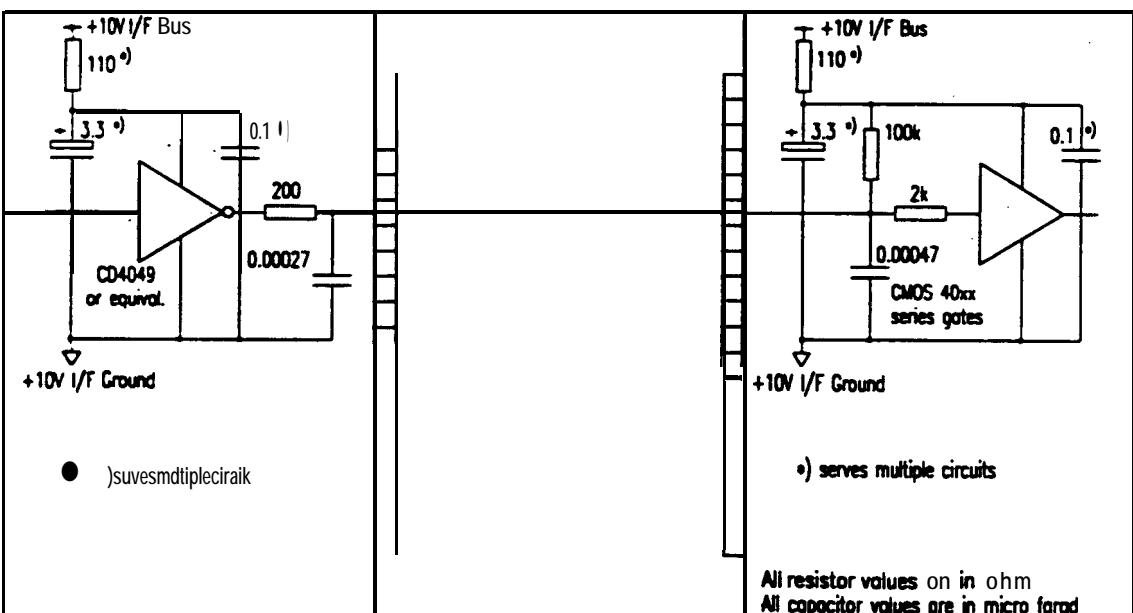


Fig. 3.5.2.1.2-12 : Digital Data A / Data Enable Interface Circuit

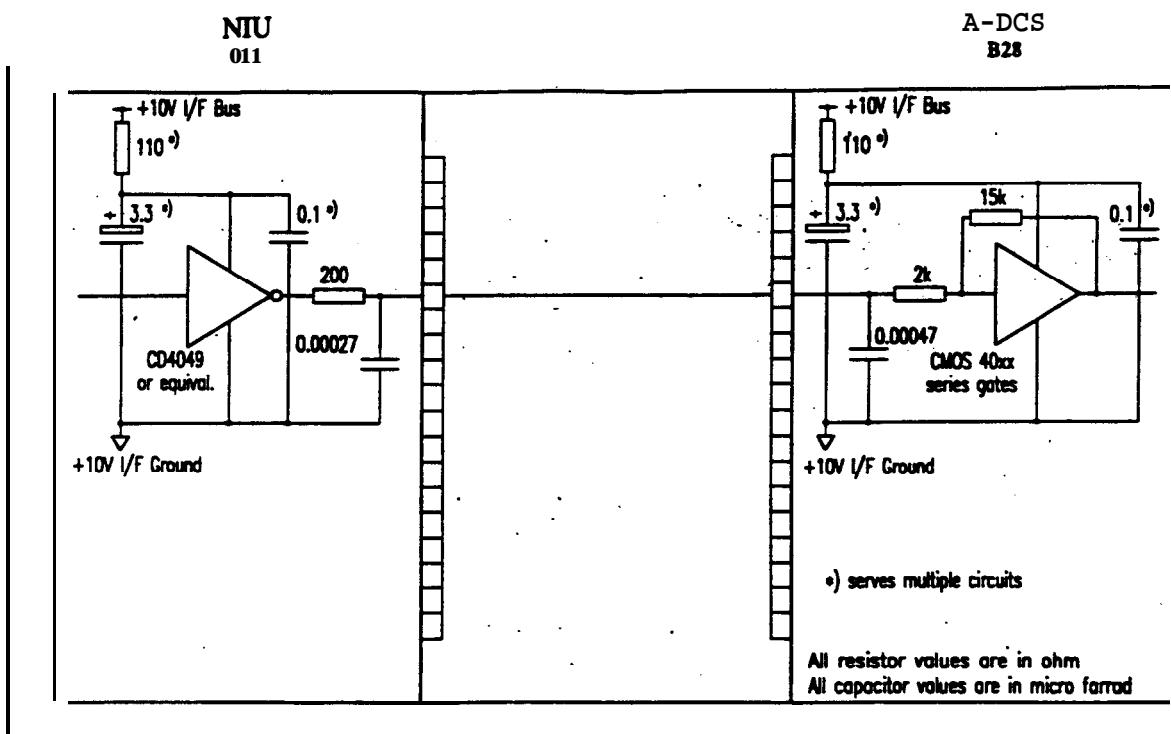


Fig. 3.5.2.1.2-13 : A-DCS 632 kHz Clock Interface Circuit

3.523. Signal Connectors (Interfaces With PLM Units)

Table 3.5.2.2-1 identifies the Signal connector types at the A-DCS boxes and Table 3.5.2.2-2 identifies the signal connector types at the A-DCS harness.

Connector	Connector-Type	Function
J209	DCMA-37P	Commands
J210	DDMA-50S	Telemetry

Table 3.5.23-I : Signal Connector *Types* at A-DCS (RPU) Boxes for Interfaces With PLM

Connector	Connector-Type	Function
P209	DCMA-37S-NMB	Commands
P210	DDMA-SOP-NMB	Telemetry

Table 3.5.2.2-2 : Signal Connector *Types* at A-DCS (RPU) Harness for Interfaces With PLM

3.5.2.3. Signal Pin Allocation Lists (Interfaces With PLM Units)

In these lists, the cross reference between connector pin, signal designation, Interface Data Sheet, target connector and target connector pin is defined. Per connector one list is prepared.

Interface Data Sheets can be found in § 3.5.2.1.1

The individual pin allocation *lists* are specified by 10 characters of a alpha numerical connector number. For the A-DCS the first 5 characters are NADCS. Character 6 is reserved. The 7th character is J for a box' connector or P for a' harness connector. The last three characters define the connector number.

Since these lists also specify wiring and shielding, they will form the basis for harness manufacturing.

The signal connector pin allocations at instrument level are described in Tables 3.5.2.3/1 and /2. The signal connector harness are described in Tables 3.5.2.3/3 and /4.

Connector : NADCS- J209 Item:		A-DCS Function: Command		Backshell : N/A			
		EMC-Category : 2		Conn.-Type : DCMA-37P			
Pin	Signal Designation	Interface-Code		Grouping			
		Circ	Signal	Pos.	Ch. ID	Std	Cable Twist Comment

Table 3.5.2.3/1 : Pin Allocation List of Connector J209 (TBD_{ADCs})

Connector : NADCS- 1210 Item:		A-DCS		Function : Telemetry		Backshell : N/A			
		EMC-Category : 2		Conn.-Type : DDMA-50S					
Pin	Signal Designation	Interface-Code		Grouping					
		Circ	Signal	Pos.	Ch. ID	Std	Cable Twist Comment		

Table 3.5.2.3/2 : Pin Allocation List of Connector J210 (TBD_{ADCs})

Connector :	NADCS-P209	Item :	A-DCS	Function :	Command	Conn.-Type :	DCMA-37S-NMB
		EMC-Category :	2	Location :	2F	Backshell :	TBD
Pin	Signal Designation	Clrc	Signal	Pos.	Interface Code	Grouping	

Table 3.5.2.3/3 : Pin Allocation List of Connector P209
(For Information Only)

Connector :	NADCS-P210	Item :	A-DCS	Function :	Telemetry	Conn.-Type :	DDMA-50P-NMB
		EMC-Category :	2	Location :	2F	Backshell :	TBD
Pin	Signal Designation	Clrc	Signal	Pos.	Interface Code	Grouping	

Table 3.5.2.3/4 : Pin Allocation List of Connector P210
(For Information Only)

3.5.3. Signal Interfaces With RFF and DTA

3.5.3.1. Signal Interface Requirements (Interfaces With RFF and DTA)

There is no signal interface requirement between METOP and A-DCS for the RF signals from and to A-DCS : interface data sheets and interface circuits are N/A.

3.5.3.2. Signal Connectors (Interfaces With RFF and DTA)

Table 3.5.3.2-1 identifies the unit mounted 'RF connector types on the signal path RPU - RFF (Accommodation **Hardware**) and TXU- DTA and Table 3.5.3.2-2 at the relevant harness.

Connector	Connector-Type	Function
J205	R 126414 (SMA)	RF signal from CRA / RFF (Accommodation Hardware)
J305	SMA	RF signal to DTA

Table 3.5.3.2-1 : Unit Mounted RF Connector Types on the Signal Path RPU/RFF and TXU/DTA

Connector	Connector-Type	Function
P205	SMA TBD _{MET}	RF signal from CRA / RFF
P305	SMA TBD _{MET}	RF signal to RFF / DTA

Table 3.5.3.2-2 : Harness Mounted RF Connector on the Signal Path RPU / RFF and TXU / DTA

3.5.3. Pin Allocation List (Interfaces With RFF and DTA)

In these lists, the cross **reference** between **connector** pin, signal designation, **Interface Data Sheet**, **target connector** and target **connector pin** is defined and recorded as **data base**. Per connector one list is Prepared.

Interface circuits of a unit **are** combined with the relevant interface circuit of the **target** unit by the **CAIE TOOL**.

Interface Data Sheers can be found in § 3.5.3.1.1

The **individual** pin allocation lists are specified by 10 characters of a alpha **numerical** connector number. For the RPU, the first 6 characters are NADCSR, and for the TXU, the first 6 characters are NADCST. The 7th character is J for a box connector or P for a harness connector. The last two /three characters define the **connector** number.

Since these lists also specify wiring and shielding, they will **form** the basis for harness manufacturing.

The signal **connectors** pin allocations are shown in Tables 3.5.3.3-1 and -2. The signal **connector harness** is shown in Tables 35.3.3-3 and -4.

35.4. Signal Interfaces Between ADCS Unik

35.4.1. Interface Data Sheet and Interface Circuit

Not applicable : this is an internal ADCS interface.

3.5.4.2. Signal Connectors

Table 3.5.4.2-1 identifies the A-DCS internal signal connector types at the RPU / TXU boxes. Description at harness level is not applicable since the harness is provided by the Instrument Supplier.

RPU		TXU		Function
Connector	Connector-Type	Connector	Connector	- ~

Table 3.5.4.2-1 : RPU / TXU *Connector Types* at Boxes *TBD_{ADCs}*

3.6. TEST INTERFACES

There is no dedicated connector for tests at system level.

3.7. HARNESS

The harness between METOP units and the A-DCS is under the responsibility of the PLM, based on the connector & pin lay-out definition and electrical performances from § 3.4 and 3.5.2.

The harness between the RF equipment and the A-DCS is under the responsibility of the Accommodation Hardware supplier based on the harness routing provided by the PLM.

The harness between the A-DCS units is under the responsibility of the Instrument Supplier, based on the harness routing provided by the PLM (the harness max length is defined for reference in § 2.2.1.) and the EMC design rules from § 3.8.1.6. and 3.8.1.7.

3.8. EMC INTERFACE DESCRIPTION

3.8.1. Electrical Bonding

3.8.1.1. General

Bonding is the method by which adjacent conductive elements are electrically connected in order to minimize any potential differences and flow of electrical currents.

To prevent corrosion and alloying, bonding of dissimilar materials shall be avoided (same group in the electromechanical series). If bonding of dissimilar metals cannot be avoided, the relative areas of the anode and cathode are important and finishing shall be applied around both materials.

The bond itself shall be resistant against corrosion and shall have an adequate cross section to carry fault currents of 7.5 A for an indefinite time.

All bonding resistance values shall apply for both directions of polarization across the bond. All bonding resistance values shall be achieved without the contribution of cable shields and surface to surface contact of moveable structural parts.

3.8.1.2. Joint Faces

Joint faces shall be clean and flat before assembly. The only permitted surface finishes are :

- clean metal, except magnesium
- gold plate on the base metal
- alodine 1200 or similar according to ML-C-5541

Any other anti-corrosion finish (anodizing) shall be removed from joint faces before bonding.

3.8.1.3. structural Park

Conductive structure parts shall be electrically bonded to each other either by direct metal-to-metal contact conductive gaskets or finishes or by use of metal bond straps.

3.8.1.3.1. DC Resistance between Mating Metal Structure Parts

The DC resistance between two mating metal structure parts shall be $\leq 2.5 \text{ m}\Omega$. The minimum size of the contact area shall be 1 cm².

3.8.1.3.2. Bonding of Movable Parts

N/A.

3.8.1.3.3. Bonding of Structural CFRP Parts

N/A.

3.8.1.3.4. Bonding of Carbon Fibre Face Sheets

N/A.

3.8.1.3.5. Bonding of Aluminium Honeycomb

Aluminium honeycomb shall be bonded to structure by a DC resistance of $\leq 10 \Omega$.

3.8.1.3.6. Bonding of Metal Fittings

N/A.

3.8.1.4. Unit **Housings**

3.8.1.4.1. Bonding of unit cases

All unit cases shall be bonded to spacecraft structure via the equipment box feet. The minimum bonding contact area shall be at least 1 cm^2 . The resistance between unit case and clean aluminium structure shall be $\leq 10 \text{ m}\Omega$.

3.8.1.4.2. Bonding of Thermally Isolated Boxes

N/A.

3.8.1.4.3. Bonding of Unit mounted on CFRP or Nonconductive **Parts**

N/A.

3.8.1.4.4. DC Resistance between Adjacent Unit Case Parts

For each **particular** box case **all** conductive **parts** shall be bonded to each other either **by direct (metal-to-metal)** or indirect **bonding** (via **conductive jumper**). The resistance **between** unit case parts shall be measured to ensure that the shielding **behaviour** of **the** unit housing is not changed between the **various** night models.

3.8.1.4.5. DC Resistance between Bonding Stud and Mounting Feet

N/A.

3.8.1.5. Thermal Blankets

N/A.

3.8.1.6. Cable and Harness Shields

3.8.1.6.1. Grounding of Cable Shields

Cable shields shall be grounded at both ends and shall be grounded at all intermediate interfaces on both sides of that interface.

DC Resistance between Cable Shields and Shield Ground Point

The DC resistance between the single cable shield and its shield ground point (at the connector, unit case, or intermediate points) shall be $\leq 10 \text{ m}\Omega$.

DC Resistance between Connector Shield Ground Pin and the Case

The DC resistance between the connector shield ground pin and the equipment chassis shall not exceed $10 \text{ m}\Omega$.

3.8.1.6.2. Bonding of Overall Harness Shields

Overall harness shields shall be terminated to the equipment case respectively connector brackets by the connector back shell or dedicated bond straps. The overall harness shield shall be grounded to structure at intermediate points (approx. every 20 cm) where the harness is mechanically fixed to the structure.

DC Resistance between Connector Back Shell and Overall Harness Shield

The DC resistance between connector back shell and overall harness shield shall be $\leq 100 \text{ m}\Omega$.

DC Resistance between Overall Harness Shield and Structure

The DC resistance between the harness shield and structure via the tie-base shall not exceed 1Ω .

3.8.1.7. Connectors

3.8.1.7.1. Design of Connectors

All connectors shall include a metallic outer shell such that the connector including cabling is completely shielded as soon as the mating connector is inserted in the box mount& part.

3.8.1.7.2. Bonding Resistance of Connector Receptacle

The connector receptacle shall be bonded to the equipment case with a DC resistance of $\leq 10 \text{ m}\Omega$.

3.8.1.7.3. Bonding Resistance of Connector Back Shell

The connector back shell as part of the cable shield shall exhibit a DC resistance of $\leq 10 \text{ m}\Omega$ (via connector receptacle) to equipment case when connected.

3.8.2. Grounding and Isolation

The grounding system of the instrument shall use separate grounds (set Figure. 3.8.2-I) as follows :

- +28 V Main Power Ground
- +28 V Switched TLM Bus
- +10 V Interface Ground
- Signal Ground

Each ground shall be electrically isolated from all other grounds within the instrument and from chassis by 100 kΩ or greater DC resistance in parallel with a stray capacitance of $\leq 50 \text{ nF}$ (TBC_{MET}).

Between the signal ground and the +28 V main power ground the isolation requirement shall be 1 MΩ in parallel with a stray capacitance of $\leq 50 \text{ nF}$ (TBC_{MET}).

3.8.2.1. +28 V Main Power Ground

The +28V main power return is grounded within the PCU to structure .

3.8.2.2. +28 .V Switched Telemetry Ground

The +28 V switched telemetry return is grounded within the PCU to structure.

3.8.33. +10 V Interface Ground

The +10 V interface return is grounded within the NIU to structure.

3.8.2.4. Signal Ground

Signal ground is the power return line for the secondary side of the instrument DC/DC converters. The signal ground is grounded within the A-DCS to structure at only one point.

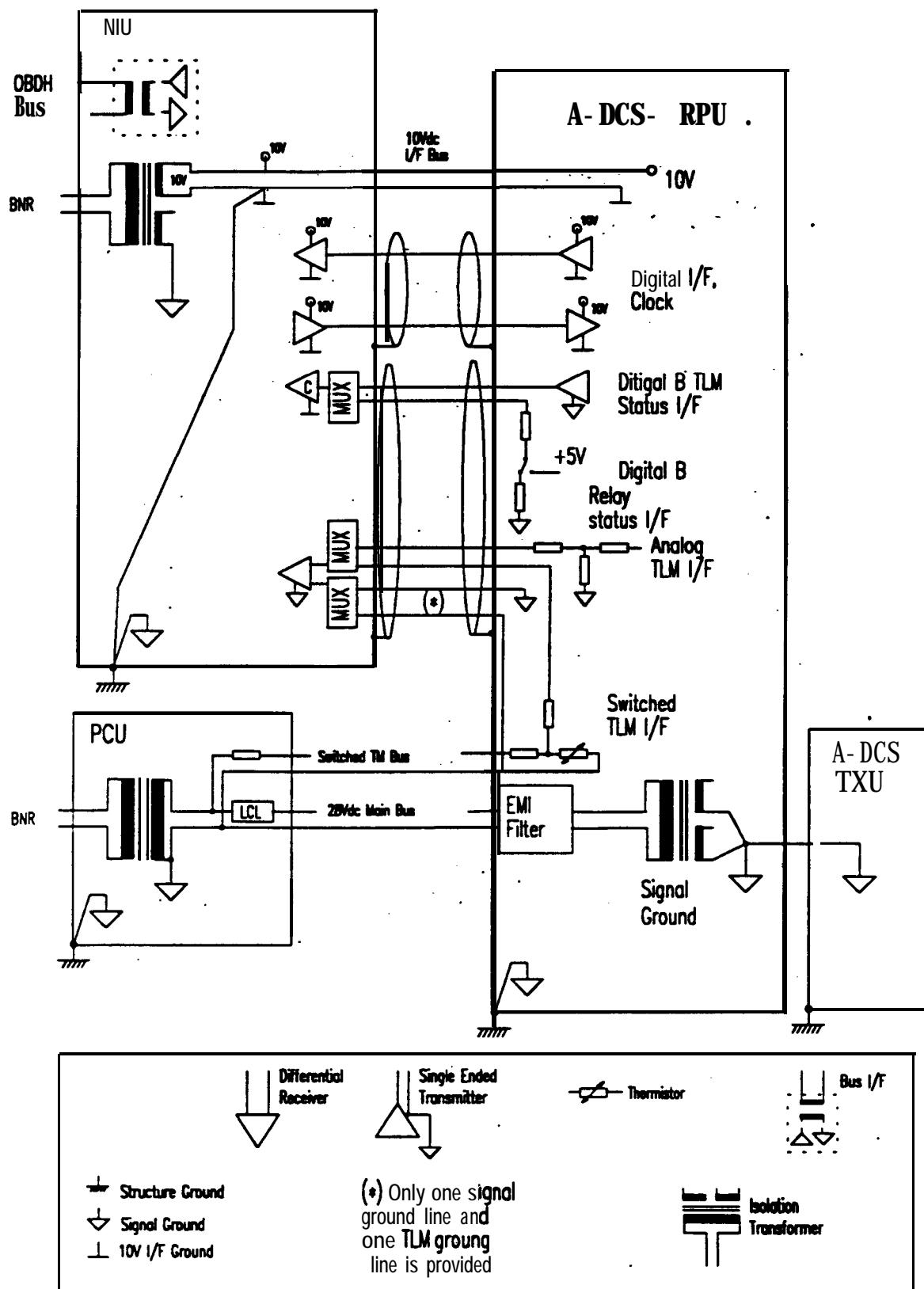


Figure 3.8.2-1 : Grounding and Isolation Concept for A-DCS

3.83. shielding

383.1. Wire shielding

3.8.3.1.1. Bonding of Shields

Wire shield shall be bonded to the connector body and shall not be routed through the connector to the inside of the equipment.

When multiple shielding is used, each shield **shall be grounded separately.**

3.8.3.1.2 Overall Shield

Overall shields shall be terminated by the connector back shell. The overall harness shield shall be made of an aluminium-foil double wrapped with at least 50 % overlapping. The tape shall have a minimum thickness of 0.03 mm and a preferred width of 25 mm.

3.8.3.1.3 Shields as Current-Carrying Conductors

Shields shall not be used as intentional current-carrying conductors and not as return lines for power and signal with exception of the RF coaxial lines.

3.83.2. Case shielding

3.8.3.2.1. Non-magnetic Metallic Housing

Each equipment housing shall be manufactured from a **non-** magnetic material, which shall form an **all-** enclosing electromagnetic shield

3.8.3.2.2. Case Apertures

The case shall not contain any apertures other than those essential for connectors, sensor viewing or **outgassing** vents.

3.8.3.2.3. Venting Holes

If **outgassing** vents are required, they shall be as small as possible (less than 5 **mm** diameter) and shall **be** located close to the unit mechanical mounting plane. i.e. spacecraft structure **ground**. Venting holes shall provide **electromagnetic** shielding performance of **≥ 40 dB** up to 18 **GHz**.

3.8.4. A-DCS Frequency Characteristics

The A-DCS RF input and output characteristics are given in § 1.2.2 and § 3.9.

The internal frequencies are :

Source	Frequency	User
TBD _{ADCs}	TBD _{ADCs}	TBD _{ADCs}

3.8.5. Magnetic Moment

The maximum magnetic moment of the instrument shall not exceed 500 mAm² (TBC_{MET}). The magnetic moment correspond to a magnetic field of 100 nT at 1 m distance (1 Gauss equals to 10⁻⁴ T).

List of Magnetic Material

Magnetic materials used in the instrument are listed in Table 3.8.5.-1

Material	Standard	Magnetic Characteristic	Remark
name of material	AISI etc.	soft /hard	
TBD _{ADCs}	TBD _{ADCs}	TBD _{ADCs}	

Table 3.8.5.-1 : Magnetic Materials Used in the Instrument

3.8.6. EMC Performance Requirements

The EMC performances for the A-DCS are dealt within § 4.3.

3.9. RF INTERFACE DESCRIPTION

The A-DCS requires one RF input at 401.635 MHz and one RF output at 465.9875 MHz (alternative: 468.8750 MHz).

3.9.1. Receive Function Characteristics

3.9.1.1. Receiver Electrical Characteristics

The A-DCS receiver functional block diagram is illustrated in Figure 3.9.1.1/1.

The electrical characteristics of the A-DCS receiver are illustrated in Figure 3.9.1.1/1.

#	Parameter	unit	Values for 401.635 MHz Receiver
a	1 dB Bandwidth	kHz	± 110 kHz
b	Receiver Noise Temp.	& g . K	< 300
c	Polarization	N/A	RHCP
d	Dynamic Range	dBW	-167 to -135
e	Linearity	N / A	2 signals at -132 dBW (TBD_{ADCs}) shall not generate a third order IMP with a power higher than -177 dBW.
f	Image Rejection (for information only)	dB	> 141 dB
g	Frequency Stability (for information only)	N/A	1.E-10 over 1 day

Figure 3.9.1.1/1: A-DCS Receiver Electrical Characteristics

TBD_{ADCs}

Figure 3.9.1.1/1.: A-DCS Receiver and Transmitter Functional Block Diagram

39.12. Receiver RF Characteristics

Each receiver can be characterized by a template which defines its capability to withstand CW or broad band noise-like interfering signals with a known degradation performance.

The receiver susceptibility data for the A-DCS are defined in Figure 3.9.1.2/1.

When illuminated by a single coherent line with a power level defined by the A-DCS template, the probability of the A-DCS receiver PLL locking on the spurious line shall be 0.

When exposed to the noise levels defined on the template, the A-DCS uplink BER shall not be degraded by a factor greater than 2.

Max Signal Level at A-DCS RF Receiver Terminal			
Frequency (MHz)	Maximum Narrow Signal Level (dBm)	Maximum Wide Signal Density (dBm/Hz)	
0 - 15	-5 (1)	-38	
15 - 375	-25 (1)	-58	
375 - 385	-65 (1)	-98	
385 - 396	-100 (1)	-138	
396 - 401.5	-125 (1)	-163	
401.5 - 401.6	-145 (2)	-183	
401.6 - 401.7	-147 (2)	-183	
401.7 - 401.8	-145 (2)	-183	
401.8 - 406	-125 (1)	-163	
406-411	-100 (1)	-138	
411-425	-65 (1)	-98	
425 - 1000	-25 (1)	-58	
1000 - 10000	-25 (1)	-58	
10000 - 200000	-25 (1)	-58	

Notes (1) and (2) are applicable to **maximum narrow band** signal levels.

- (1) Measured in "narrow band" defined in **MIL STD 461C/462 EMC** requirements
- (2) **Measured** in a "100 Hz" bandwidth using a low noise preamplifier and a **spectrum** analyzer. **This** specification is for narrow band interferer.

Note : **METOP** assumes that the A-DCS receivers are compatible with any emission from ground.

Figure 3.9.1.2/1: A-DCS Receiver Susceptibility (A-DCS Template)

3.9.2. Transmitting Function Characteristics

392.1. Transmitter Electrical Characteristics

The electrical characteristics of the A-DCS transmitter are the following :

Parameter	Unit	Value
Centre Frequency	MHz	465.9875 (back-up : 468.875)
Frequency Stability	N/A	10 ⁻⁵
Modulation Index	Rad. (RMS)	0.8 ± 10 %
Data Rate	bps	200 or 400
Nominal Power Output of Transmitter	W	5.0 TBC _{ADCS}
Bandwidth	kHz	3
Modulation Type	N/A	PCM Bi-phase-L / PM

3.9.2.2. Transmitter RF Characteristics

3.9.2.2.1. Discrete Spurious Emission Limits

Discrete spurious emission shall not exceed the limits of the following table. CF is the carrier frequency.

Frequency Range Above and Below Carrier Frequency (MHz)	Power Level (for any 1 MHz bandwidth) (dBm)
Up to 1 MHz (CF ± 1 MHz)	37
1 MHz - 30 MHz	-23
Above 30 MHz	-53

3.9.2.2.2. Noise-Like Spurious Emission Limits

The noise-like spurious levels shall not exceed the limits of the following table. CF is the carrier frequency.

Frequency Range Above and Below Carrier Frequency (MHz)	Power Level (dBW/Hz)
Up to 30 MHz (CF ± 30 MHz)	TBD _{ADCS}
Above 30 MHz	-153

3.9.2.2.3. Specific Out-of-Band Emission Levels

Frequency Bands (MHz)	Requirement at ADCS Transmitter Output (dBm)	Receiver Affected by Spurious Signals	Notes
114 - 118	-49	SARR 121 MHz	1
118 - 120	-88		1
120 - 121.45	-113		2
121.45 - 121.55	-169		5
121.45 - 121.55	-133		2
121.55 - 123	-113		2
123 - 125	-88		1
125 - 129	-49		1
228 - 236	-48		1
236 - 240	-86		1
240 - 242.925	-111	SARR 243 MHz	2
242.925 - 243.075	-167		5
242.925 - 243.075	-131		2
243.075 - 246	-111		2
246 - 250	-86		1
250 - 258	-48		1
375 - 385	-42	SARR 406.05 MHz	1
385 - 396	-77		1
396 - 411	-102		1
401.5 - 401.8	-160		5
401.5 - 401.8	-124		2
405.9 - 406.2	-160		5
405.9 - 406.2	-124		2
411 - 425	-77		1
425 - 435	-42		1
1207 - 1267	-90	GRAS	3
1555 - 1624	-88		3
2043.0 - 205 1.9	-34	S-Band	4
205 1.9 - 2055.0	-102		4
2055.0 - 2063.0	-34		4
5253 - 5256	-98	ASCAT	4
5253 - 5256	-151		5

Notes :

- 1) Measured in a narrow band defined in **MIL STD 461C/462 EMC** requirements.
- 2) Measured with a 100 Hz bandwidth
- 3) Integrated power over any 500 kHz band
- 4) Discrete spurious, only one allowed in the frequency band.
- 5) Broad band noise (in dBm/Hz) **TBC_{MET}**

Table 3.9.2.2-1 : A-DCS Transmitter Out-of-Band Characteristics

MATRA MARCONI SPACE

A-DCS

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4. INSTRUMENT VERIFICATION DESCRIPTION

MATRA MARCONI SPACE

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This section specifies the **instrument level verification requirements**.

All items to be flown on the satellite have to be qualified. An item that has been already qualified needs only acceptance testing when qualified to levels same as or greater than specified for METOP. If qualification by similarity is claimed, this has to be justified by analysis and documented with previous achieved qualification reports.

4.1. MECHANICAL / STRUCTURAL VERIFICATION

4.1.1. Structural Analysis

4.1.1.1. Quasi-Static Loads

A stress analysis shall demonstrate that the instrument interface structure design is compatible with the METOP design loads, based on the flight limit loads from § 2.28.

4.1.1.2. Structural /Dynamic Analyses

In those areas where verification by test cannot or has not been performed, a verification by analysis is required in following areas :

- Stress analysis of instrument critical parts.
- Instrument structural analyses, for frequency mode definition.

4.1.1.3. Instrument Shock Environment

The following shock levels apply for METOP. Compliance with these requirements shall be verified by analysis.

METOP Shock Levels (g peak, See notes)		Notes
100 Hz	37 g	
900 Hz	350 g ($Q > 10$)	
	310 g ($Q = 10$)	
2000 Hz	350 g ($Q > 10$)	
	310g ($Q= 10$)	
4000 Hz	300 g	
		The acceleration shall be derived from the curve obtained by linear connection on a logarithmic chart of the provided points
		The shock spectrum in each direction of the three orthogonal axes shall be equivalent to a half sine pulse of 0.5 ms duration and 200 g (zero to peak) amplitude.

4.1.2. Structural Tests

4.1.2.1. Structural Mathematical Model Validation

Not applicable for A-DCS.

4.1.2.2. Vibration Test : High Level Sine Sweep

The A-DCS does not exhibits any major structural mode below 100 Hz (Cf. § 228.4.).

The following METOP test level requirements apply :

High Level Sine Sweep Test Levels (TBC _{MET})	
METOP Requirements	
Q	All three axes 6 to 20 Hz ±9.3 mm 20 to 60 Hz ±15 g 60 to 100 Hz ±6 g Sweep rate : 2 Oct/min. No notching is allowed
U	All three axes 6 to 20 Hz ±7.5 mm 20 to 60 Hz ±12 g 60 to 100 Hz ±4.8 g sweep rate : 4 Oct/min. No notching is allowed
A	
C	
C	

4.1.2.3. Vibration Test : Sine Burst

Not applicable..

4.1.3.4. Vibration Test : Random Levels

A random test shall be performed with the following METOP levels.

For the definition of the METOP requirements, masses of 15 kg / 7 kg for A-DCS RPU / TXU have been assumed. Final levels will depend on the actual instrument mass and launch environment, and will be scaled accordingly.

Levels are defined in the Table 4.1.2.4-1.

4.1.2.5. Acoustic Test

No test is required at instrument level.

Random Vibration Test Levels (TBC _{MET})					
QUALIFICATION			ACCEPTANCE		
Axis Perpendicular to Mounting Plane			Axis Perpendicular to Mounting Plane		
Frequency Range (Hz)	Power Spectral Density g ² /Hz	Slope (dB/Oct.)	Frequency Range (Hz)	Power Spectral Density g ² /Hz	Slope (dB/Oct.)
20 to 100		+3	20 to 100		+3
100 to 400	0.153 (RPU) 0.236 (TXU)		100 to 400	0.098 (RPU) 0.152 (TXU)	
400 to 2000		-3 out-of-plane	400 to 2000		-3 out-of-plane
Overall level : 12.3 g rms normal (RPU) 15.3 g rms normal (TXU) Duration 2 min per axis			Overall level : 9.9 g rms normal (RPU) 12.3 g rms normal (TXU) Duration 1 min per axis		
Horizontal axes 1 & 2 (in the mounting plane)			Horizontal axes 1 & 2 (in the mounting plane)		
Frequency Range (Hz)	Power Spectral Density g ² /Hz	Slope (dB/Oct.)	Frequency Range (Hz)	Power Spectral Density g ² /Hz	Slope (dB/Oct.)
20 to 100		+3	20 to 100		+3
100 to 400	0.153 (RPU) 0.236 (TXU)		100 to 400	0.098 (RPU) 0.152 (TXU)	
400 to 2000		4 in-plane	400 to 2000		
Overall level : 11.4 g rms normal (RPU) 14.1 g rms normal (TXU) Duration 2 min per axis			Overall level : 9.1 g rms normal (RPU) 11.3 g rms normal (TXU) Duration 1 min per axis		

Table 4.1.2.4-1 : Random Levels For A-DCS

4.2. THERMAL VERIFICATION : THERMAL TESTS

4.2.1. Thermal Balance Test

The A-DCS units will be submitted to a thermal balance test, performed at METOP system level to validate the overall satellite thermal control subsystem.

4.2.2. Thermal Vacuum Tests

During the METOP programme, the instrument will not experience temperatures other than those specified in § 2.3.2

- I The thermal cycle vacuum tests at instrument level are required to evaluate and demonstrate the functional performance of each unit under the extreme and nominal modes of operation while in vacuum and at temperatures more extreme than predicted for the orbit conditions.

The instrument qualification thermal vacuum test includes TBD_{ADCs} cycles and the extreme temperature levels are TBD_{ADCs} deg. C (min.) / TBD_{ADCs} deg. C (Max).

The instrument acceptance thermal vacuum test includes TBD_{ADCs} cycles and the extreme temperature levels are TBD_{ADCs} deg. C (min.) / TBD_{ADCs} deg. C (Max).

4.3. EMC VERIFICATION

43.1. EMC Performance Requirements

43.1.1. Conducted Emission

The conducted emission on each individual power line shall not exceed the limits as given below.

- Limits for +28 V Main Power Bus

- a) As given in § 3.4.3. (Load Current Ripple)
- b) Conducted emission in the frequency range 30 Hz to 50 MHz, which may appear on positive and return leads in differential and common mode, shall be within the maximum specified levels of Fig. 4.3.1.1-1.

Note : The maximum frequency of 50 MHz can be reduced to the highest frequency (+9 harmonics) used by the instrument.

The Common Mode CE requirement is a specific METOP requirement.

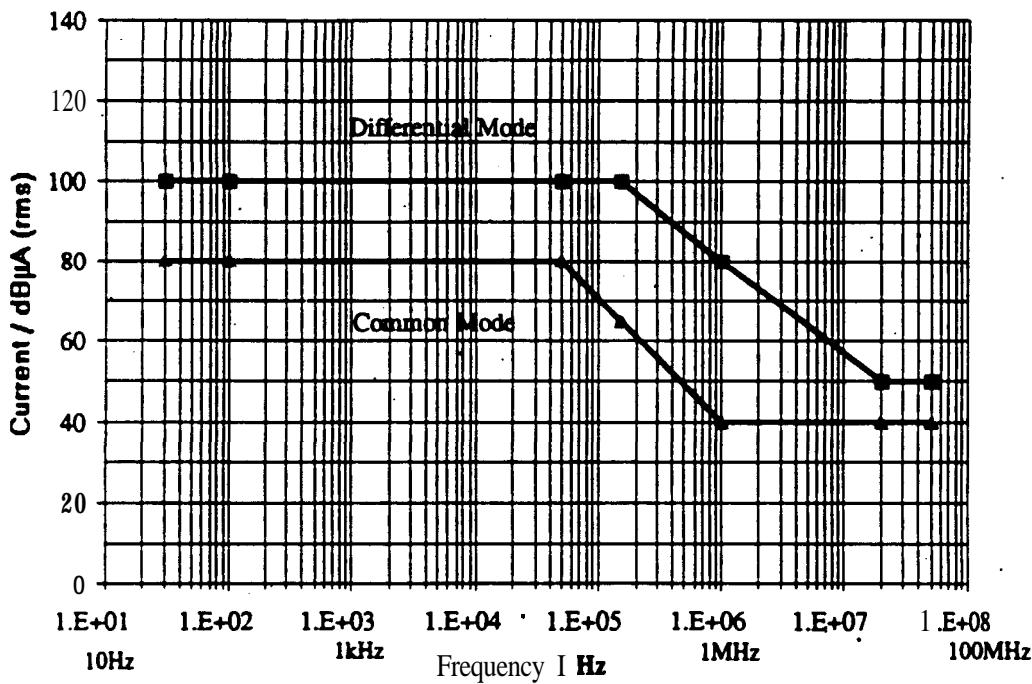


Fig. 4.3.1.1-1 : **Conducted Emission Limit NB, 28V Main Power Leads, PLM Instrument**

- Limits for +28 V Switched TLM Bus

As given in § 3.4.3. (Load Current Ripple)

- Limits for +10V Interface Bus

As given in § 3.4.3. (Load Current Ripple)

43.13. Conducted Susceptibility

Frequency Domain

The instrument shall operate without degraded performance in the presence of sinusoidal noise coupled into the power lines between the frequency range 30 Hz and 150 kHz :

+28 V Main Bus / +28 V Switched TLM Bus	injected Voltage	300 mVpp
+10 V Interface Bus	injected Voltage	100 mVpp

The test set-up shall be in accordance to § 4.3.3.

Time Domain

The instrument shall operate without degraded performance when subjected to a series of transient pulses, 10 μ sec in width and PRF of 10 Hz applied to the power lines for 10 min. :

+28 V Main Bus / +28 V Switched TLM Bus	spike level	+10 V / -12 V
+10 V Interface Bus	spike level	+1 V / -1 V

The test method CS06 shall be in accordance to § 4.3.3.

Special METOP Requirement

The instrument shall operate without degraded performance in the presence of common mode sinusoidal noise 300 mVpp in the frequency range 100 kHz and 50 MHz. The noise shall be injected between :

- the +28 V main bus return line and unit housing, according to Figure 4.3.1.2-1
and the +10 V interface bus return line and unit housing. according to Figure 4.3.1.2-2

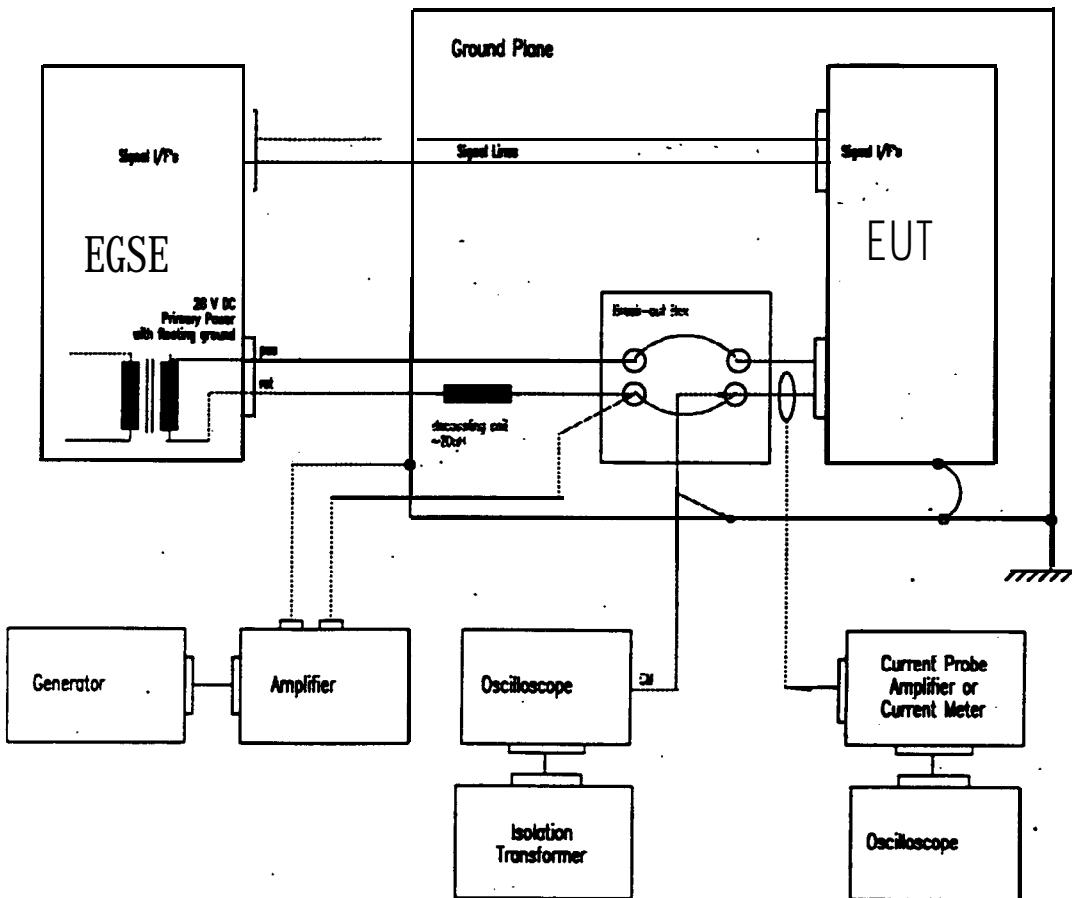


Fig. 4.3.1.2-I : Common Mode **Noise** Test on the +28 V Main Bus

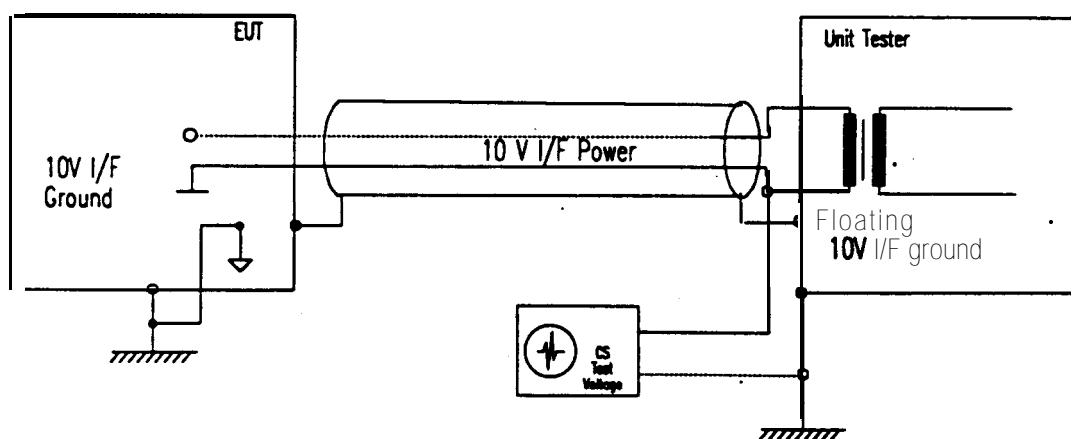


Fig. 4.3.1.2-2 : Common **Mode** Noise Test on the + 10 V **Interface** Bus

4.3.1.3. Radiated Emission

Radiated emission in the frequency range 14 kHz to 2 GHz shall not exceed the limit given in Figure 4.3.1.3-1 measured in 1 m distance. In addition the instrument shall not exceed the limits in the specific frequency bands as listed in Table 4.3.1.3-1, measured in 1 m distance. The receiver bandwidth shall be selected in such a way that the ambient noise is below the limit. The test is defined in § 4.3.3.

Frequency Range (MHz)	E-Field Level (dBμV/m) TBC_{MET}	Remark
120 - 121.45	+ 34	SARR
121.45 - 12155	+ 15	
121.55 - 123	+ 35	
240 - 242.925	+ 41	SARR
242.925 - 243.075	+ 21	
243.075 - 246	+ 41	
401.8 - 405.9	+ 45	SARP
405.9 - 406.2	+ 23	
406.2-411	+ 45	
205 1.9 - 2055.0	+ 45	SBS
5254.7 - 5255.3	+ 63	ASCAT
1217 - 1257	+ 21	GRAS
1565 - 1614	+ 23	

Table 4.3.1.3-I : **Radiated Emission Notches for A-DCS**

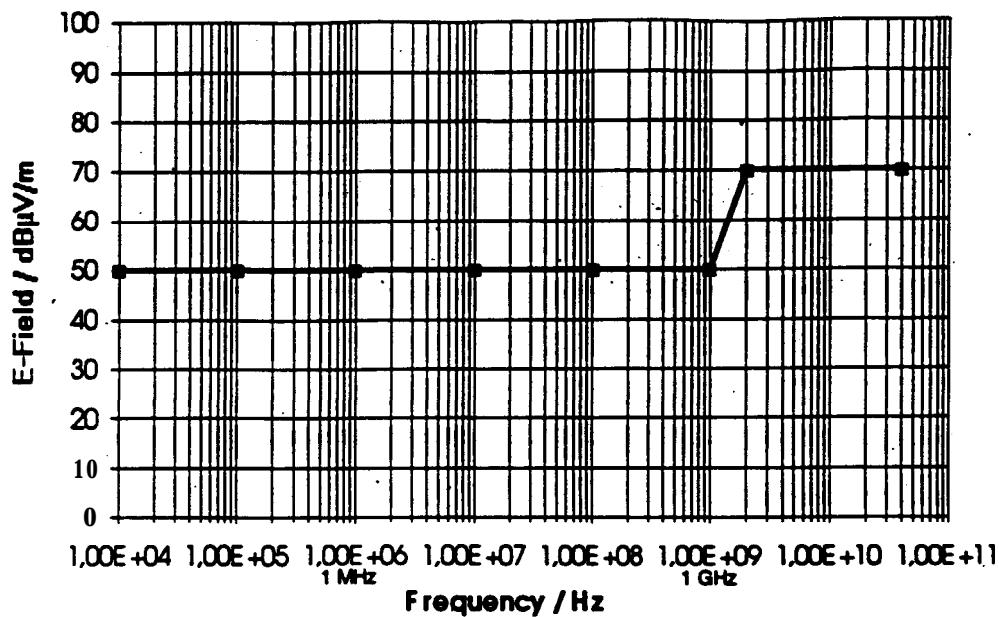


Figure 4.3.1.3-I : Radiated Emissions, NB, AC Electric Field Limit

4.3.1.4. Radiated Susceptibility

The instrument shall operate without degraded **performance** while subjected to a radiated **electric field** of 1 Vrms/m for **frequencies between 14 kHz and 1 GHz** and 2 Vrms/m for **frequency between 1 GHz and 18 GHz**. The radiated E-Field shall be **amplitude** modulated by a sine wave at 1 **kHz** with a modulation depth of 50 %.

The test method is defined in § 4.3.3.

4.3.2. EMC Analysis

It is the responsibility of the Instrument Supplier to verify the compatibility of the instrument with the EMC requirements, as defined in § 3.8. The verification can be done either by analysis or test, except those items identified in § 4.3.3.

Magnetic Moments

The magnetic moments shall be determined by analysis and confirmed by the incoming inspection.

4.3.3. EMC Tests

The compatibility of the A-DCS with the requirements shall be verified by test for :

- conducted emission
- conducted susceptibility
- radiated emission
- radiated susceptibility

EMC tests shall be performed in accordance with MIL-STD-462C.

The Radiated Emission tests are applicable on all models delivered to METOP.

The Conducted Emission, Conducted Susceptibility and Radiated Susceptibility tests are applicable only on the first instrument model delivered to METOP.

4.4. ELECTRICAL FUNCTIONAL VERIFICATION

The test which are described here are performed at instrument level to validate the instrument functional performances.

Tests performed after delivery, performed under METOP responsibility, are described in § 5.

4.4.1; . Electrical **Interface** Tests.

The following **test** shall be **performed prior** to delivery to **METOP**:

- **Verification of all interfaces as specified in this ICD.**
- **Verification of instrument operation, commanding and monitoring with simulated METOP interfaces.** **This** shall be done in all **instrument** operational modes.

4.4.2. Functional Test

It is the sole responsibility of the **Instrument Supplier to define and verify the proper functions of the instrument** prior to **delivery** to **METOP**. This type of tests are tailored to the specific **instrument** function verification **and they serve as instrument health checks** that are performed **routinely throughout the instrument development programme**. A subset of these tests will constitute later the core of the system testing when the **instrument** is integrated on-board the **PLM**.

Test results of these tests shall be **provided as reference** for **further** tests **performed under METOP responsibility**.

4.4.3. Performance Test

It is also the sole responsibility of the **Instrument Supplier to define and verify the ultimate mission performances** of the **instrument** prior to **delivery** to **METOP**. This type of tests are tailored to **the** specific **instrument performances** and they are achieved ultimately with the insmunent calibration which requires a **rather sophisticated** and controlled test set-up.

A subset of these tests may **later** constitute **the** system **performance** test with a reduced on-ground set-up. A go / no-go approach is preferred at system level (**PLM** and Satellite), due to the compkxity of the test set-up and the **AIT** schedule limitations.

Calibration

It is the sole responsibility of the **Instrument Supplier** to calibrate **the instrument** prior to delivery to **METOP**. Re-calibration, if deemed necessary, will also be under **the** responsibility of **the** Instrument Supplier. The calibration data shall be made available **on-request** for **the** preparation of the system integrated instrument **performance** test.

5. INSTRUMENT GSE AND AIV INTERFACES

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A-DCS

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5.1. INSTRUMENT GSE DESCRIPTION

5.1.1. Bench Test Equipment

The Instrument Supplier will provide all test equipment **required** for bench test of the instrument. This equipment shall **include** a Satellite Simulator, a Stimuli Generator, a Data Processing ‘module and a Computer. Figure 5.1.1-1 provides an overview of the bench test **set-up**. It is required that bench tests are carried out with the instrument **placed** in a shielded **enclosure** to prevent’ **interference** from the electromagnetic **ambient**.

The test equipment is a stand alone equipment that simulates the spacecraft interfaces and provides the RF stimuli and outputs. The test equipment used for the A-DCS is also **used** for SARP-3 (see SARP-3 ICD). Simultaneous operations with **A-DCS** and **SARP-3** are not **possible**. Details are **TBD_{INST}**

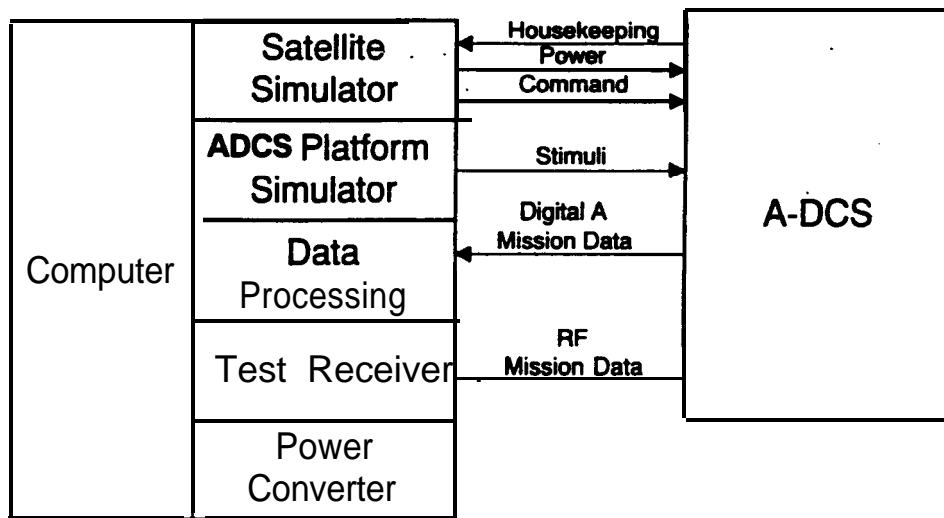


Figure 5.1.1-1 : Overview of the Bench Test Set-Up

The **ADCS** Bench Test Equipment can be used in an end-to-end test, including the **METOP** provided antenna. It accepts a RF input from the ADCS transmitter via RF coaxial cables or via intermediate antenna test cap. Details about Bench Test Equipment receptor sensitivity is **TBD_{ADCS}**.

Standard laboratory equipment such as spectrum analyzer, power meter, **counter** can be made available by **METOP** to support bench tests of the instrument : **TBD_{INST}**

5.1.2. GSE for Integration with PLM OCOE

The test equipment for integration into the PLM overall check-out equipment (OCOE) will be provided by the instrument. One set consists of the following items :

- a platform simulator for generation of test messages to the instrument
- a test receiver / demodulator for retrieval of the down linked test messages from the instrument

If needed, the same tests can be performed with the Bench Test Equipment (platform simulator / test receiver).

5.13. Mechanical Ground Support Equipment

Drill jig : N/A.

Containers shall be supplied for shipping and storage at the METOP integration and test sites for each deliverable instrument.

The instrument storage containers will be sealed and back-filled with dry N2 to one atmosphere (TBC_{INST}).

Protective covers and connector savers shall be delivered with each instrument for all connectors.

5.1.4. Self-Contained Special Test Equipment

Not applicable (TBC_{ADCS}).

5.2. INSTRUMENT GSE INTERFACES

5.2.1. Interfaces with PLM OCOE

5.2.1.1. General

The configuration of the A-DCS instrument test equipment within the overall check-out equipment for the METOP payload module is shown in Figure 5.2.1.1-1. The same configuration will be used for TB/TV tests, however with a longer interconnect harness between instrument and stimuli equipment and additional test chamber feed throughs connectors.

5.2.1.2. Stimulus/Feedback Equipment Interlace

5.2.1.2.1. Physical / Electrical Interface

The communication between the DAPB controller and the A-DCS platform simulators shall be accomplished via a full duplex three wire serial RS 232 port.

The N-DAPB shall provide an input for the A-DCS test messages from the test receiver with the following characteristics :

- Code : PCM Bi-phase L
- Format : **HDLC**
- Interface Circuit : **differential (RS-422)**
- Input Impedance : **100 Ohms +/- 10%**
- Input Voltage : **"1" -6V to -1 v**
"0" +1V to +6V
- Absolute maximum voltage : **-1v , +7V (referenced to signal ground)**

The command and control interface between the A-DCS receiver and the N-DAPB shall be accomplished via a RS 232 asynchronous serial link

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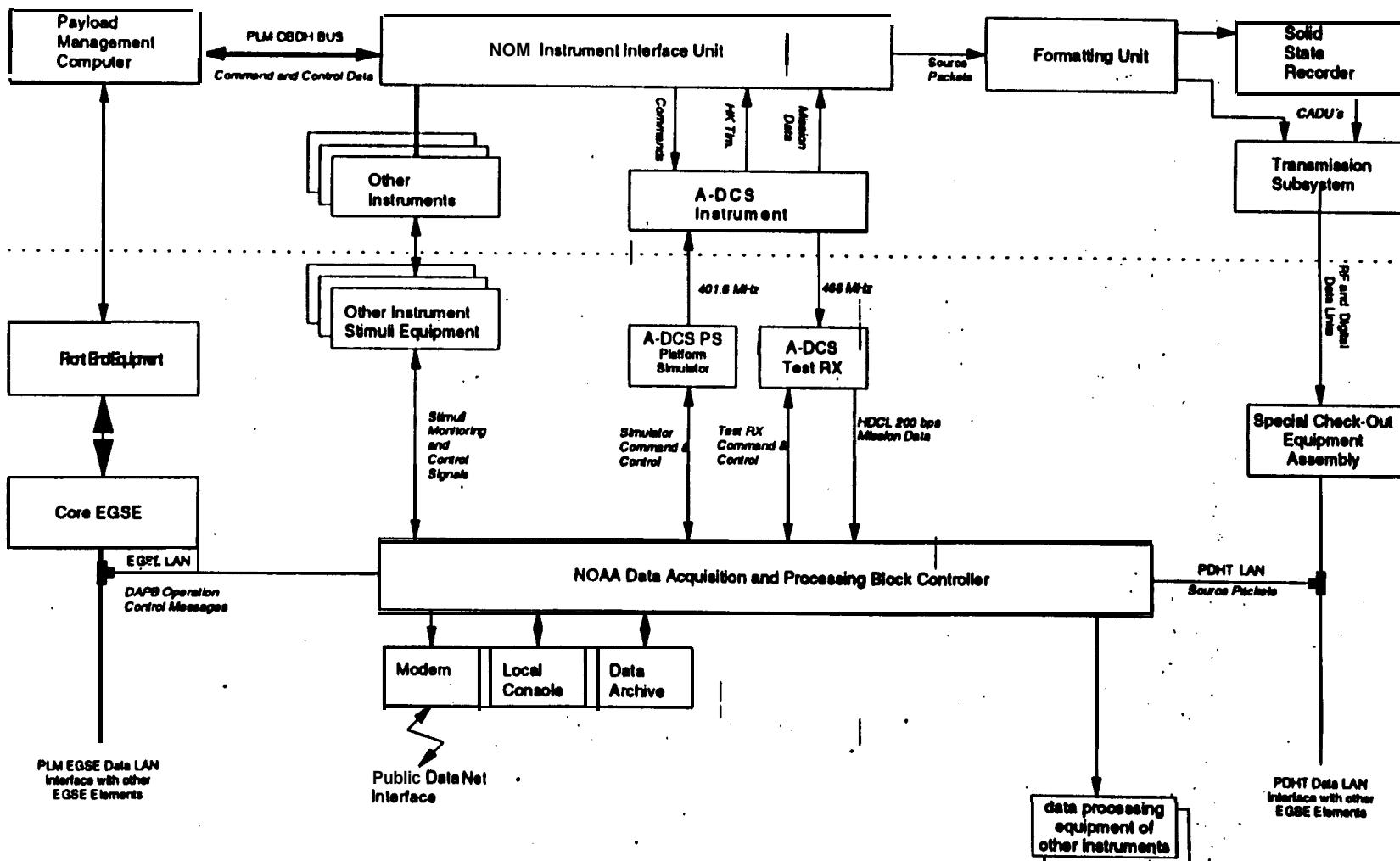


Fig. 5.2.1.1-1 : Test Equipment Interfaces With PLM OCOE
in Ambient Test / Thermal Vacuum Configuration

5.2.1.2.2. Protocol Interface

The RS 232 port shall be configured as follows :

- data rate : 9600 baud
- parity check : None TBC_{ADCs}
- data bits : 8 TBC_{ADCs}
- start bits : TBD_{ADCs}
- stopbits: 1 TBC_{ADCs}

Messages exchanged between **platform** simulators and **the N-DAPB controller** shall have a length of up to 7 Bytes including CR and LF at the end of each message.

The communication protocol for **message handling** will be similar to AD7.

5.2.1.2.3. Stimulus/Feedback Data Handling Requirements

Command and control messages **between** the N-DAPB **and** the A-DCS platform **simulator and the test receiver** shall be logged by **the N-DAPB controller**.

5.2.1.3. Interface with Instrwnent provided Data Processing Equipment

N/A to A-DCS.

5.2.1.4. Measurement Data Evaluation

5.2.1.4.1. Instrument Measurement Data Format Definition

The A-DCS mission data contain test messages which are generated in **the platform** simulator. **The** data are routed to the N-DAPB via **one** of the following **links**:

- via the PLM payload handling and transmission system **and the** SCOE assembly
- via the HDLC input **from** the A-DCS test receiver

The **instrument measurement data** formats and contents will be **different** on those links. They are defined in § 3.3.

5.2.1.4.2. Reference Data Presentation

Reference data for a bit by bit comparison need not be **imported** but are fixedly stored in the DAPB controller.

5.2.1.4.3. Data Comparison Requirements

The A-DCS data shall be processed following the principle procedure outlined below :

Inputs required :	<ul style="list-style-type: none"> • measurement data source packets containing A-DCS messages • messages from A-DCS test receiver (via 200 or 400 bps HDCL interface) • test message data sets
Processing Principle :	<ul style="list-style-type: none"> • acquire A-DCS messages from source packets and HDCL link • bit by bit comparison with test messages • error counting and analysis • BER calculation
Outputs generated :	<ul style="list-style-type: none"> • number of bit errors and BER • detailed bit error protocol (location of error, source packet sequence count)

The reference data **patterns** for the bit by bit **comparison** are defined in : **TBD_{NST}**

5.2.1.4.4. Data Processing Algorithms

N/A to A-DCS.

5.2.2. Interfaces with the PLM On-Board Equipment

5.2.2.1. Test Harness and Connectors

No specific A-DCS test connector.

RF test **cables** and attenuators (up to 130 dB) shall be provided by **METOP** at the input / port of the instrument. RF decoupling between simulator and **instrument is required**.

On PLM / system levels, spacing of > 10 m between the instrument and the check-out equipment is needed.

5.2.2.2. Special Test Adapters (T-Junctions, Break-Out Boxes)

Instrument to PLM avionics interfaces are all via **standard sub-D type connectors**, therefore no special **adapter** is needed from the **instrument**.

Instrument is supplied with **connector savers**.

5.3.23. Stimuli Source Configuration /Arrangement Requirement'

N/A

5.2.3. Interfaces with other PLM GSE

N/A

5.3.4. Interfaces with AIT and Launch Site Facilities**5.2.4.1. Mains Power**

The instrument test equipment will be operated from mains power via a METOP-provided isolation transformer with the following output characteristics:

- Voltage: 230 V AC ($\pm 10\%$), 10 A max., single phase
- or 400 V AC ($\pm 10\%$), 25 A max., three phase
- Frequency: 50 Hz ± 1 Hz

The actual estimated steady state power consumption of the instrument is as follows :

- Bench Equipment: < 2.5 kVA
- Rx & Simulator : < 1 kVA

5.2.4.2. Cooling / Thermal Dissipation Requirements

N/A

5.2.4.3. Purging Gas Requirements

N/A

5.2.4.4. GN₂ / LN₂ Supply

N/A

5.2.4.5. Test Chamber Wall Feed-Through Panels

For TV test, two coaxial / RF cable feed-throughs for the A-DCS shall be provided.

5.2.4.6. Public Data Net Communication Requirements

The METOP AIT and launch site facilities will provide access to a public data network in order to enable data exchange with Instrument Suppliers (e.g. for off-line data evaluation at the A-DCS Instrument Supplier premises).

For this purpose, file transfer procedures via INTERNET will be used.

5.2.4.7. Physical Interface5

(GSE weight dimensions, floor loading, door width, and others TBD_{INST} by A-DCS)

The bench test equipment consists of two full-sized 2 m high, 483 mm (19 in.) wide racks. For stimuli and feedback equipments, four drawers of 10 u. / 483 mm (19 in.) are needed :

- one for the receiver
- 2 for the platform (PTTs) simulation
- 1 for the atomic clock.

These units shall be integrated in the METOP provided EGSE racks.

For set-up of the instrument test equipment an area of TBD_{INST} m² as a minimum shall be provided in a temperature and humidity controlled class 100,000 clean area.

5.3. INSTRUMENT GROUND OPERATION REQUIREMENTS

5.3.1. General

Instrument operational constraints are presented in § 1.4.1. Test procedures may deviate from these.

Instrument modes and in orbit operations are described in § 1.4 and § 1.5.

Instrument t&commands are described id § 3.2.2.

For the ground **operations**, the acknowledgement of the commands by the instrument is done using Analog Housekeeping and Digital B data from the **instrument**, as described in § 3.23.

Conditions for testing

TBD_{INST}

53.2. Command and Contrd Sequences

The testability of the **instrument depends** on the usage of **equipment** as is outlined in Table 5.3.2-1 below. **Command and control sequences** will be implemented in the **check-out** software of the METOP overall check-out equipment **in terms** of control, **files** for automated testing. The control **files** will **ensure** that the **instrument** is operated and tested in **accordance** with the objectives given **below**. Control files will be coded on the basis of test procedures prepared by the METOP AIT team following inputs from the **Instrument Supplier**. and checked by the **instrument supplier**.

Control files shall take into account the generic operation requirements given above, and the special requirements for ambient and TV testing given in the following subchapters.

TBD_{INST}

Table 5.3.2-I : *Test Objectives Versus Test Configurations*

53.2.1. Ambient Conditions

No special ambient condition shall be observed. The same sequences as described in § 1.5 apply here.

53.2.2. Thermal Vacuum Conditions

No special thermal vacuum condition shall be observed. The same sequences as described in § 1.5 apply here.

53.3. Hazards / Precautions

The stimulus equipment shall be operated such that a -15 dBm input level at the **instrument** is not exceeded.

5.4. INSTRUMENT ACCEPTANCE AT AIT SITE

5.4.1. Unpacking / Packing and Handling Requirements

No specific requirement.

5.4.2. Incoming Inspection

The incoming inspection starts as soon as instrument equipment arrives at the integration site. After unpacking under cleanroom conditions, the following will be carried out :

- Visual **Inspection of Instrument** and GSE
- Dimensional / flatness check
- unitsweighing
- Bench Testing

Bench Level Tests

Prior to installation and to the PLM and electrical integration with PLM avionics, the instruments shall undergo a bench level check-out to demonstrate aliveness and instrument readiness for the subsequent system level AIT activities.

The instrument will be set up on a test bench (e.g. a table with conductive surface) and shall be connected to the instrument test equipment. In those cases where instruments are accommodated on dedicated panels, they will be mounted directly to the panel. The panel itself is supported by a standard panel handling and turnover trolley. Then a series of check-out activities shall be carried out as required to validate the instrument readiness.

The bench test equipment shall be provided by the **Instrument Supplier** and shall reside at the PLM and satellite AIV sites to support instrument troubleshooting if necessary. Operation of the instrument and its bench test equipment is done by the **Instrument Supplier team with support of the METOP AIV team** in accordance to the following instrument-provided procedures and manuals :

TBD_{INST}

5.43. Instrument Self-Compatibility Test

Not applicable.

5.5. INTEGRATION ON METOP

5.5.1. Pre-Integration

5.5.1.1. Integration with Accommodation Hardware

TBD_{MET}.

5.5.1.2. Pre-Integration with NIU

Prior to the installation in the PLM, the instrument will be pre-integrated with the NIU and parts of the NIU test equipment as well as the power conditioning unit. The corresponding set-up of on-board units and ground support equipment is shown in Figure 5.5.1-1.

The purposes of the pre-integration activities is to verify electrical interfaces between instruments and NIU and PCU, to develop instrument specific test sequences, and to refine and validate the DAPB operation separately from the PLM level AIT in order to reduce the overall integration time.

The activities carried out with the instruments in the NIU pre-integration are electrical integration and instrument IST's as described in § 5.5.3 below.

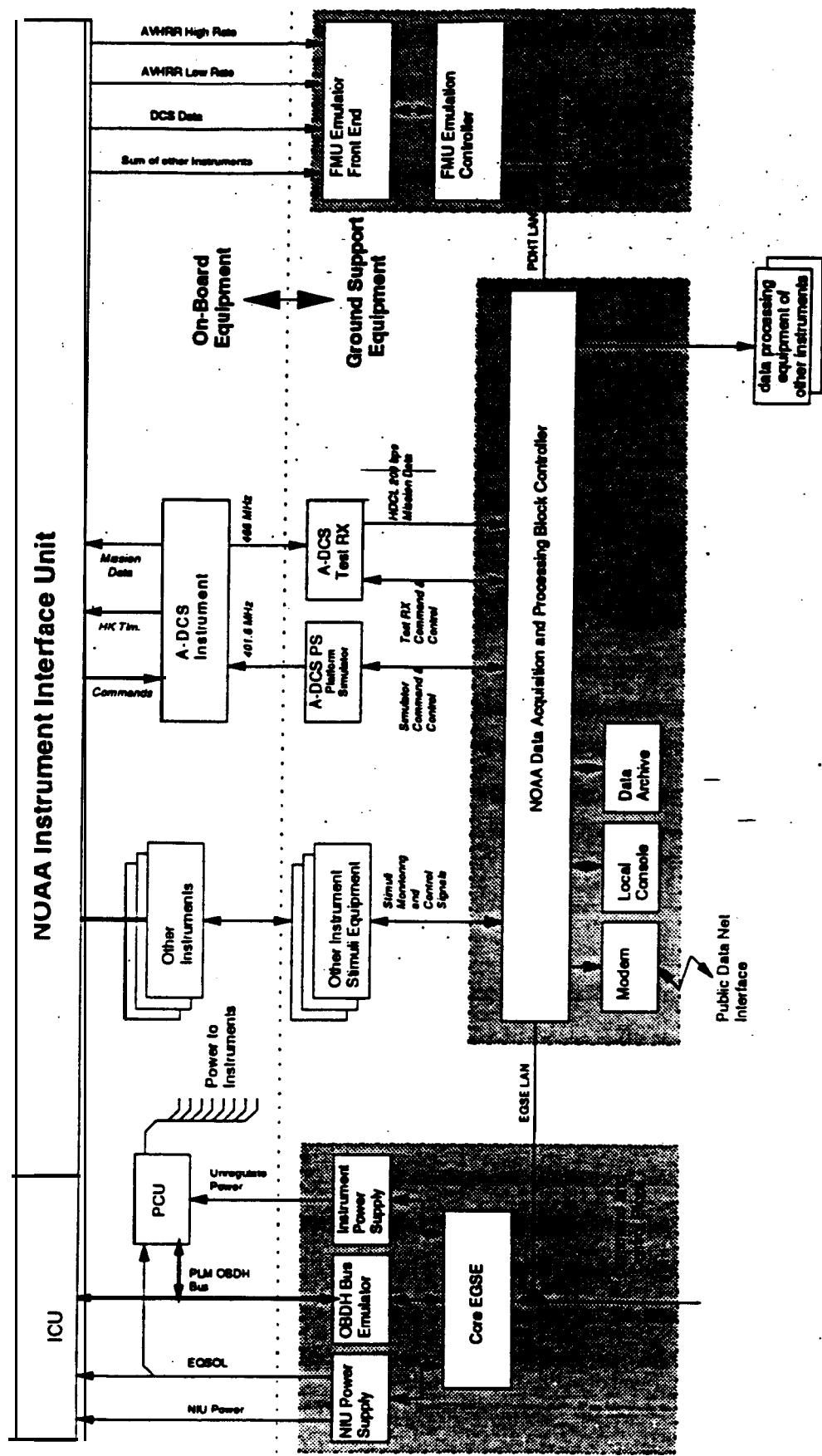
The physical arrangement of the instruments during pre-integration will be on desks with conductive surface. The interconnection to the NIU and PCU is accomplished with a METOP-provided test cable harness. Pre-integration activities are done in a clean room environment as required.

After completion of the pre-integration activities the instruments together with the NIU and the PCU will be installed in the payload module. An abbreviated electrical integration and part of the IST's are then repealed.

5.5.2. Mechanical / Thermal Integration

The instrument mechanical / thermal integration includes the following activities :

- Physical installation to associated PLM panels according to agreed procedures including thermal insulation / filling and other
- Mechanical adjustment as required
- Installation of thermal fillers / insulators as required
- Mounting of thermal blankets
- Bonding measurement between equipment case and PLM structure
- Mechanical integration of pre-integrated instrument panels to the payload carrier structure

Figure 5.5.1-I : Set-Up for **Instrument Pre-Integration**

5.5.3. Electrical Integration and IST's

The electrical integration of the instrument is done after the integration of its GSE. The purpose of the electrical integration of the ~~instrument~~ on-board equipment is twofold : to verify that the interfaces between the instrument and the PLM avionics are as specified, and to accomplish instrument operation commissioning within the PLM environment.

The following activities are carried out for electrical interface verification :

Instrument Grounding/Isolation Check : before mating any connector with the system harness it is verified, that designated grounding pins are properly terminated to chassis, and other connector pins are isolated

Safety Check : it is verified before connecting the system harness, that there is no unexpected dangerous voltage, nor a short to chassis **ground**

T-Junction Tests : instrument connectors are mated with the PLM harness one by one via T-junctions, which allow **measuring** signal characteristics. Power connectors are mated first, followed by command interface connectors and telemetry interface connectors. The instrument is operated from the PLM Command & Control Block (CCB) by **sending** commands manually. Essential signal parameters such as rise/fall times, signal levels, signal timing, inrush **currents** and power consumption are recorded and compared against **expected (specification)** values.

The instrument electrical integration procedures will be prepared by the PLM AIT team on the basis of inputs from the **Instrument** Supplier, and reviewed and supported by the **Instrument** Supplier.

Verification of the **instrument** interfaces will be followed by an **instrument** IST. The purpose of this test is to perform a reference instrument **check-out** in the **overall** system environment.

The instrument will be operated in all relevant modes including degraded modes and redundancy activation. Full instrument **operability validation** is achieved in the IST. This comprises both the on-board equipment and the **ground** support equipment and check-out software. It is to be noted that the check-out **software**, at least the **AIT** data base with the **TM/TC parameter definitions** will be re-used during mission operation. Instrument **specific** control files will be refined and validated in the IST.

In addition to the above objectives, the IST **serves** to produce reference data sets for the subsequent **environmental** and system **function** test **programs**.

55.4. Integration of GSE**5.5.4.1. Integration of GSE with the Flight Equipment**

Procedures : TBD_{INST}

5.5.4.2. GSE Integration with PLM OCOE

The EGSE integration is done prior to the integration of the on-board equipment. During this activity, the instrument-provided test equipment shall be connected with the METOP provided PLM EGSE. Generally, EGSE integration basically consists of an end-to-end communication check to demonstrate full operability under control of the Command and Control Block (CCB).

The instrument GSE integration procedures will be prepared by the PLM AIT team on the basis of inputs from the Instrument Supplier, and reviewed and supported by the Instrument Supplier.

5.6. INSTRUMENT OPERATION CONSTRAINTS DURING PLM AND SATELLITE SYSTEM TESTS

5.6.1. System Environmental Test Levels

5.6.1.1. Structural Tests

No specific condition shall be observed in addition to those described in § 2.

5.6.1.2. Thermal Tests

No specific condition shall be observed in addition to those described in § 2.

5.6.1.3. EMC/RFC Tests

Static magnetic fields in excess of 2 Gauss will degrade the ultra stable oscillator performance. No damage will occur to the instrument.

See also § 5.3.3.

5.6.2. Function and Performance Tests

The following descriptions shall provide a better understanding of the system level tests and are to be understood as for information only.

5.6.2.1. System Functional Tests (SFT)

The system functional test will verify the overall system performance and operability in a series of mission relevant modes. Back up modes, & graded modes and mode transitions will be included. The SFT procedures will be composed of control files which have been validated during IST's.

5.6.2.2. Special Performance Test (SPT)

SPT's serve to execute specific performance verifications in the overall system configuration for all those parameters which have contributions from more than one subsystem or for test cases which require a special set-up and operation condition. A typical example is a bit error performance test which involves elements of data acquisition, formatting and transmission.

For the instrument, it is assumed that full performance has been demonstrated as part of the instrument acceptance test program, and therefore no instrument specific performance testing is required on system level.

5.6.2.3. Abbreviated Functional Tests (AFT)

The abbreviated function test is composed of a subset of control files and procedures from the system functional test. Its purpose is to demonstrate system integrity after major set-up changes and after transport. No measurement data evaluation will be included in the AFT's but only a verification that the measurement data streams are present. Therefore, no instrument stimulus generation and feedback data acquisition will be done.

Note : The feasibility of such test depends on the access to the interface when the satellite is fully integrated. Alternative SFT methods are TBD_{INST}

5.7. INSTRUMENT CONSTRAINTS ON GROUND ENVIRONMENTAL CONDITIONS

5.7.1. AIT Site

Bench testing with the instrument shall be done in a shielded enclosure (provided as GSE by the Instrument Supplier) to prevent interference from electromagnetic ambient. Such a requirement is not applicable for tests at METOP level.

Test connector : N/A.

Connector dust caps shall be installed when the instrument is not in use.

5.73. Launch site

TBD_{INST}

5.73. Transportation

To avoid damage to the instrument, it shall be transported in a sealed container when not yet integrated to the spacecraft: For ~~transport~~ monitoring shock and temperature recorders shall be used.

5.7.4. Storage

For instrument storage the sealed containers shall be used. Purging is not required.

The storage temperature extremes shall be as per § 2.3.2.1.

The humidity limits shall not exceed 90 percent when the instrument is in the shipping container and sealed. When the shipping container is open, the humidity limit shall be less than 55 percent. Under no condition shall the humidity be allowed to approach the dew point.

Other maintenance, as for example re-calibration, is not planned during storage.

5.8. LAUNCH CAMPAIGN

5.8.1. Launch Preparation

Check-Out on the Launch Range

Instrument launch operations before encapsulation of the satellite into the launcher fairing will be a series of functional tests as already done during the AIT phase. After encapsulation of the satellite, there will be only limited command and control access via umbilical to the service module and the payload module avionics. Therefore, instruments will generally not be operated after spacecraft encapsulation.

5 . 8 . 2 . Red Tagged Items

N/A

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6. PRODUCT ASSURANCE

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The PA approach for the A-DCS is dealt within AD1. Specific PA constraints / rules are dealt within the following sections.

6.1. CLEANLINESS/ CONTAMINATION

6.1.1. Deposited Contamination Level

At the instrument delivery to METOP, the deposited contamination levels shall be less than:

- External surfaces :

Molecular contamination : $\leq 2 \cdot 10^{-7} \text{ g/cm}^2$

Particulate contamination : level 500, as per ML-STD-1246B

- Internal surfaces : levels compatible with the instrument performances.

These contamination levels shall be certified at delivery, and verification performed after packing / transportation and arrival to the METOP integration site.

6.1.3. Integration Facilities

The instrument, after delivery, will be integrated in a class 100 000 clean room. as per FED-STD-209D, or better.

6.1.3. Instrument Aperture Protection

N/A for A-DCS.

6.1.4. Purging

No purging is required for the A-DCS during METOP satellite or PLM level AIT activities.

During transit and during storage, the A-DCS units should be stored in its shipping container, that has been purged and back-filled with dry nitrogen.

6.1.5. Space Conditioning

Bake-out of instrument harness and MLIs at 60 deg. C : No (TBC_{AVCS}).

6.1.6. Contamination Witness Plate

Not applicable : the A-DCS is not sensitive to contamination.

6.1.7. Decontamination Features / Heaters

N/A to A-DCS.

6.1.8. Instrument Bagging

NIA for the A-DCS.

6.2. FAILURE PROPAGATION THROUGH THE INTERFACES

The failure propagation through the interfaces from the A-DCS to METOP is analysed within TBD_{ADCS} .

The failure propagation through the interfaces from the METOP to A-DCS is analysed within TBD_{MET} .

6.3. SAFETY REGULATIONS

The A-DCS shall be compliant with the safety requirements from AD1.

The following is a list of hazards contained within the instrument, its associated Ground Support Equipment, and any other special equipment needed for transportation, handling, assembly, integration and test.

Hazard	item
Radioactive Source	None
Toxic Sources	None
Corrosive Materials	None
Pressurized Systems	None
Ignition Sources	None
Pyrotechnics / Ordonance	None
Cryogenics /Cooling Fluid	None

Table 6.1/1 : Hazard List

The following is a list of consequences of failures of the instrument, its associated GSE and any other special equipment needed for transportation, handling, assembly, integration and test.

Consequence	Reference to Safety File
Violation of mechanical requirements	None
Violation of electrical requirements	None
unintentional pyro firing	None
Violation of radiation requirements	None
Unintentional ignition	None
Release of debris	None
Leakage / rupture	None
Unintentional deployment	None

Table 6.1/2 : Consequence of Failures